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(12) **United States Patent**
Cormier et al.

(10) **Patent No.: US 9,402,673 B2**
(45) **Date of Patent: Aug. 2, 2016**

(54) **DEVICES AND METHODS FOR BREAKING AND RETAINING SURGICAL REDUCTION TABS**

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(72) Inventors: **Philip A. Cormier**, Quincy, MA (US); **Richard W. Fournier**, New Bedford, MA (US); **Ernest Quintanilha**, Norton, MA (US)

(73) Assignee: **DePuy Synthes Products, Inc.**, Raynham, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 291 days.

(21) Appl. No.: **14/021,203**

(22) Filed: **Sep. 9, 2013**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 61/706,860, filed on Sep. 28, 2012.

(51) **Int. Cl.**

A61B 17/88	(2006.01)
A61B 17/70	(2006.01)
A61B 17/00	(2006.01)

(52) **U.S. Cl.**

CPC ***A61B 17/8863*** (2013.01); ***A61B 17/7074*** (2013.01); *A61B 2017/0023* (2013.01); *A61B 2017/00429* (2013.01); *A61B 2017/00433* (2013.01)

(58) **Field of Classification Search**

CPC A61B 17/708; A61B 17/7032–17/7047; A61B 17/7074–17/7091; A61B 17/8863

USPC ..... 606/86 A, 300–321

See application file for complete search history.

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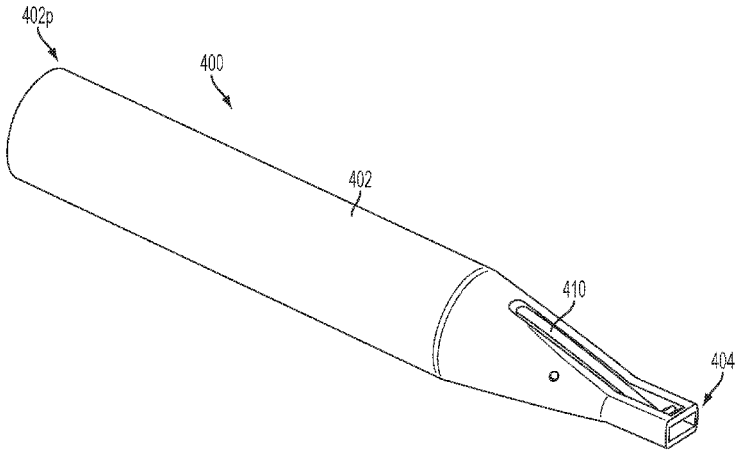
Primary Examiner — Christian Sevilla
Assistant Examiner — Eric S Gibson
(74) *Attorney, Agent, or Firm* — Nutter McClennen & Fish LLP

(57) **ABSTRACT**

Various devices and methods for breaking and retaining surgical reduction tabs are provided. In general, the devices and methods can allow a single surgical instrument to break a plurality of surgical reduction tabs off one or more surgical implants and retain the broken tabs within the instrument. In an exemplary embodiment, a surgical instrument can include an opening at a distal end thereof that is configured to receive a surgical reduction tab therein when the tab is connected to a surgical implant. A retention element at least partially disposed within the instrument can be configured to engage the tab received in the opening so as to hold the tab securely within the instrument. With the tab received in the opening and held by the retention element, the surgical instrument can be configured to be manipulated to break the tab off the surgical implant. The broken tab can be retained within the surgical instrument by being held therein by the retention element. The instrument can be repeatedly relocated and repeatedly break off surgical reduction tabs of one or more surgical implants, with each successive tab received in the opening displacing the immediately preceding broken tab from the retention element such that a chamber formed in the instrument can simultaneously hold a plurality of broken tabs within the instrument.

20 Claims, 29 Drawing Sheets



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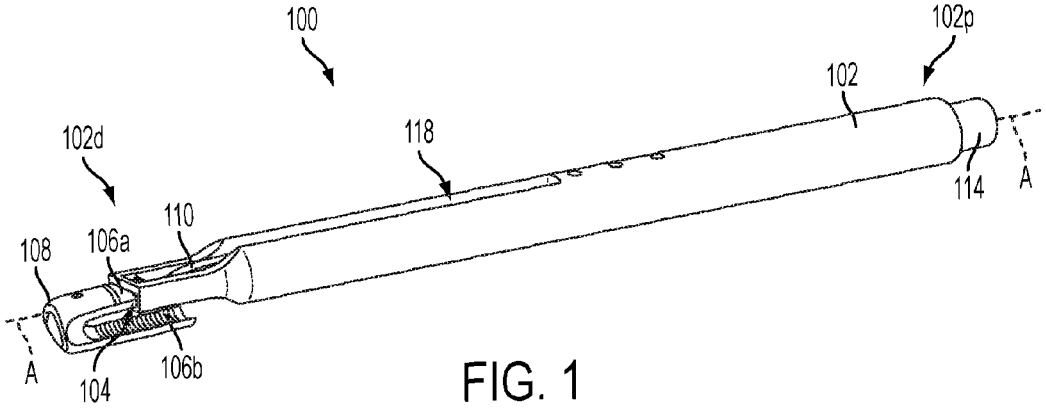


FIG. 1

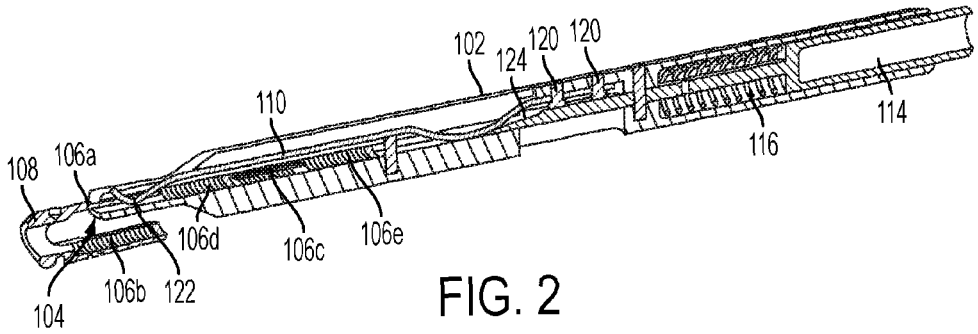


FIG. 2

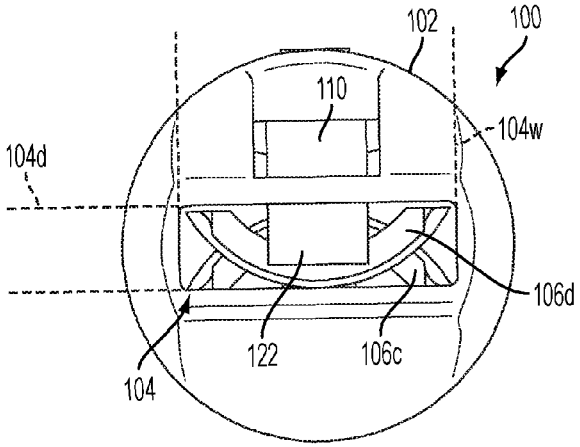
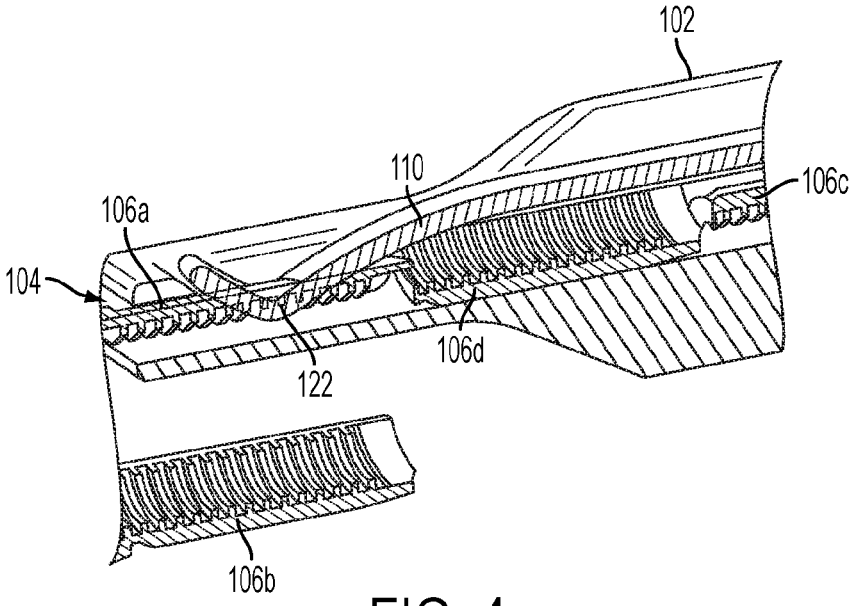


FIG. 3



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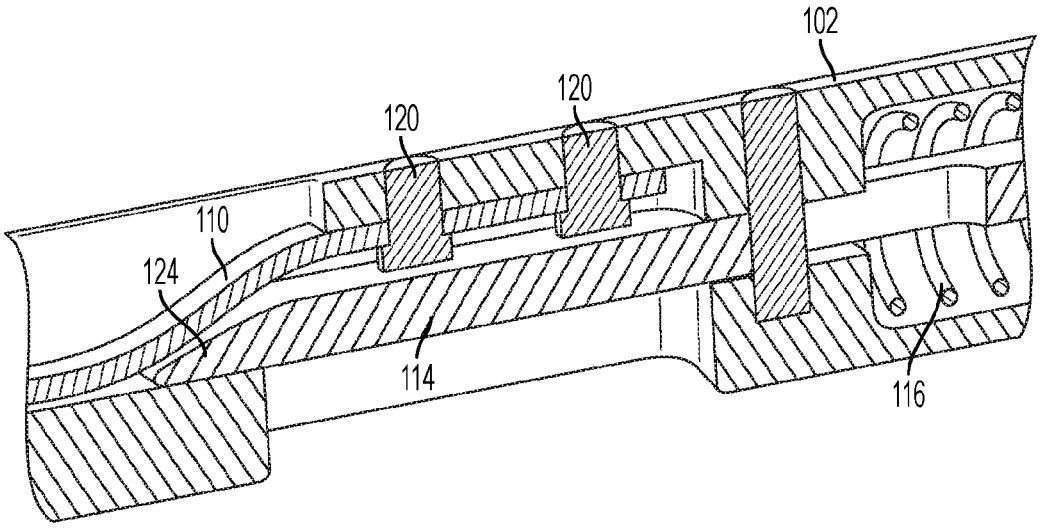

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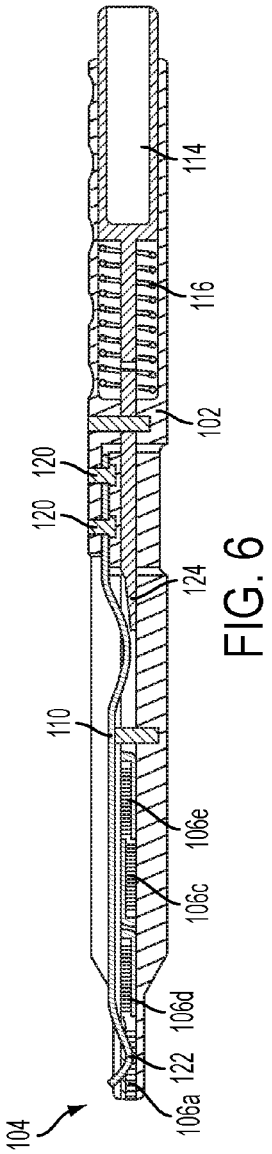

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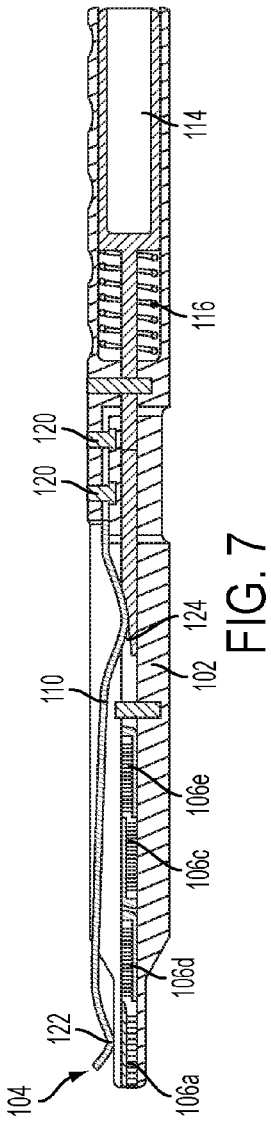

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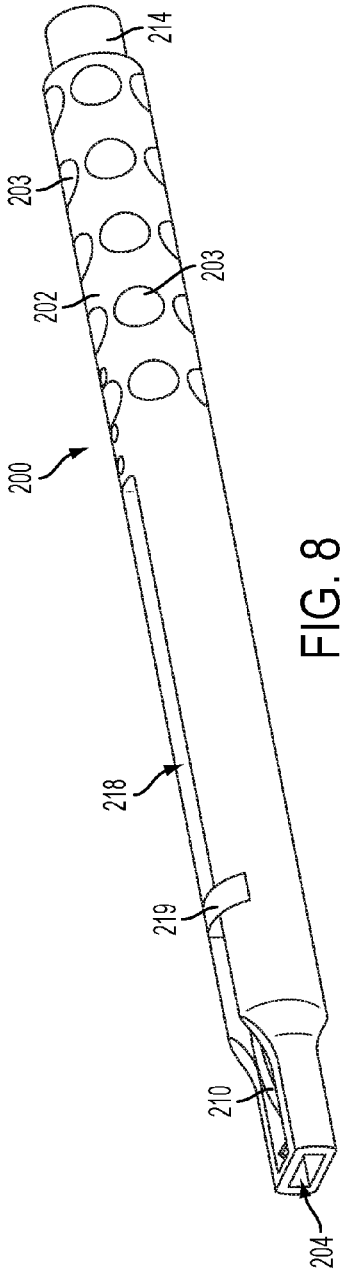

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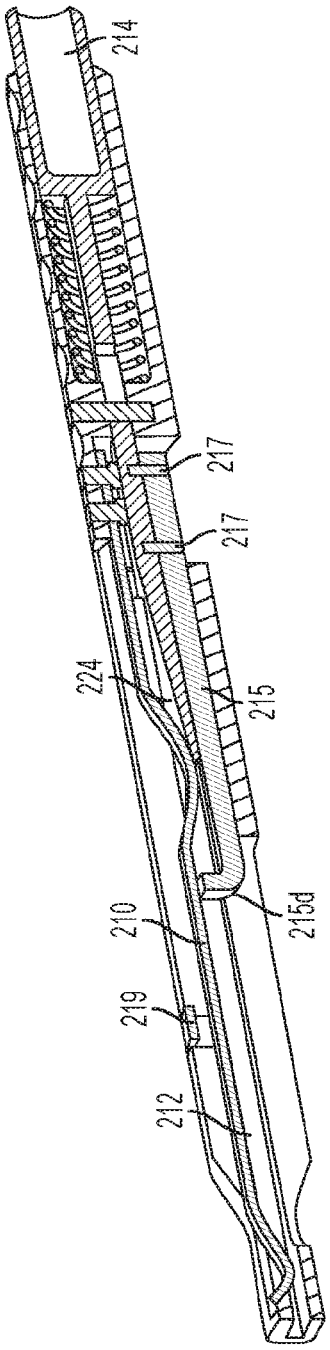
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FIG. 9

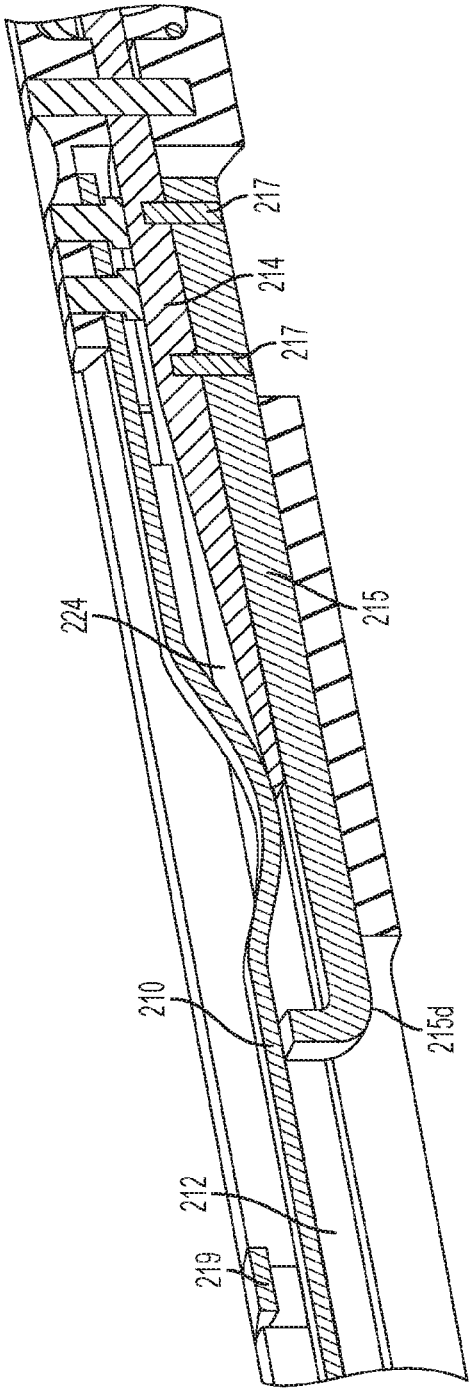
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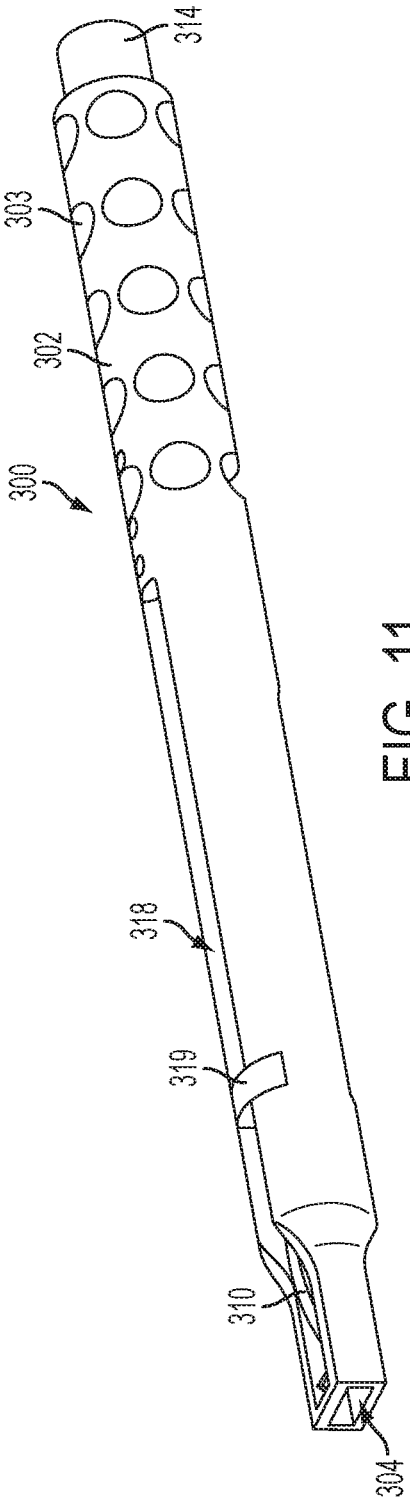
FIG. 10



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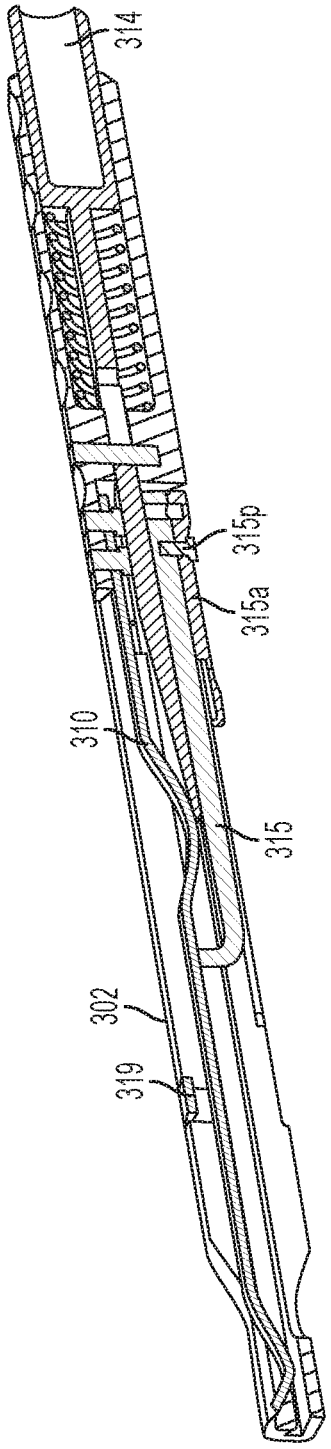

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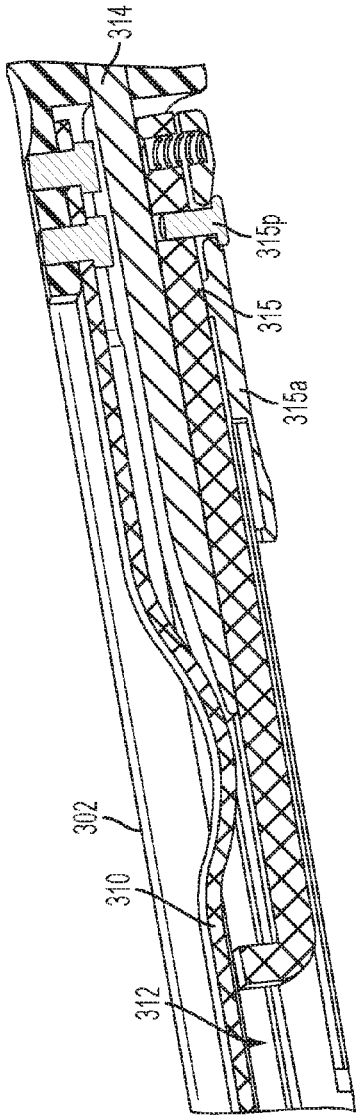

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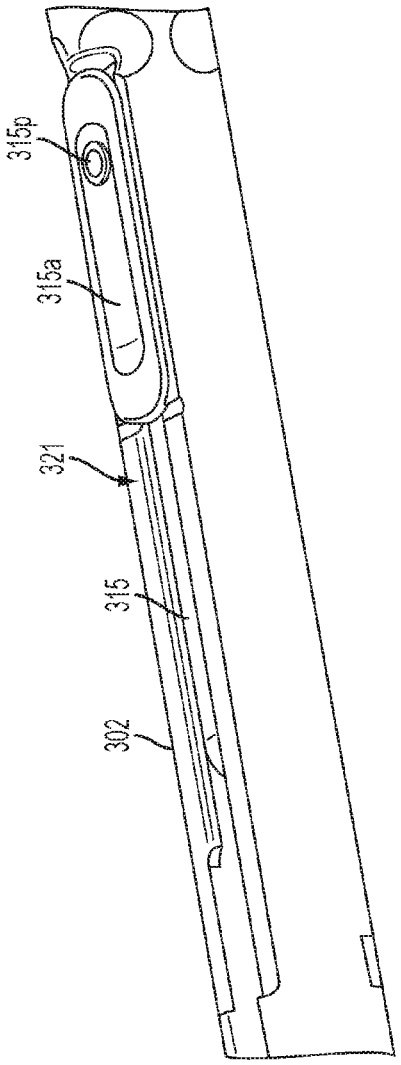

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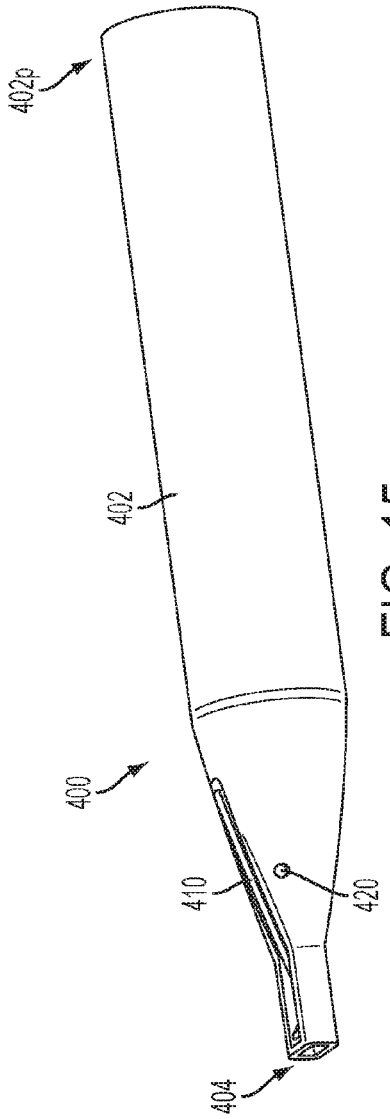

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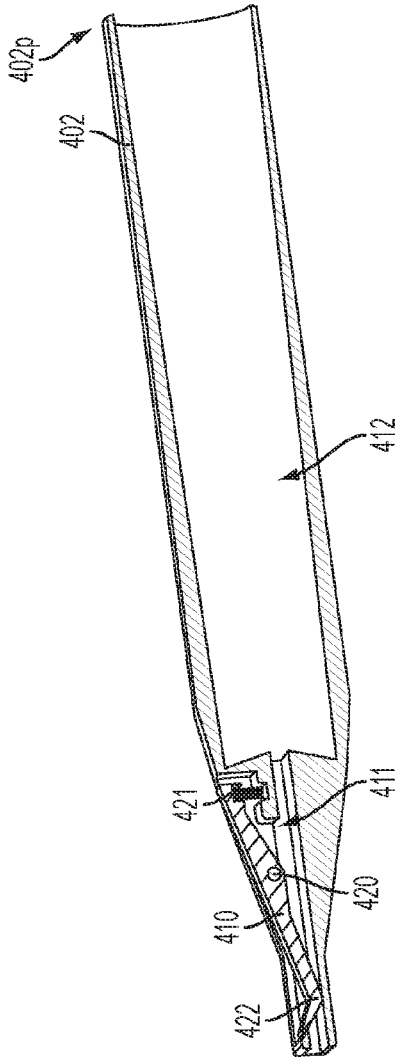

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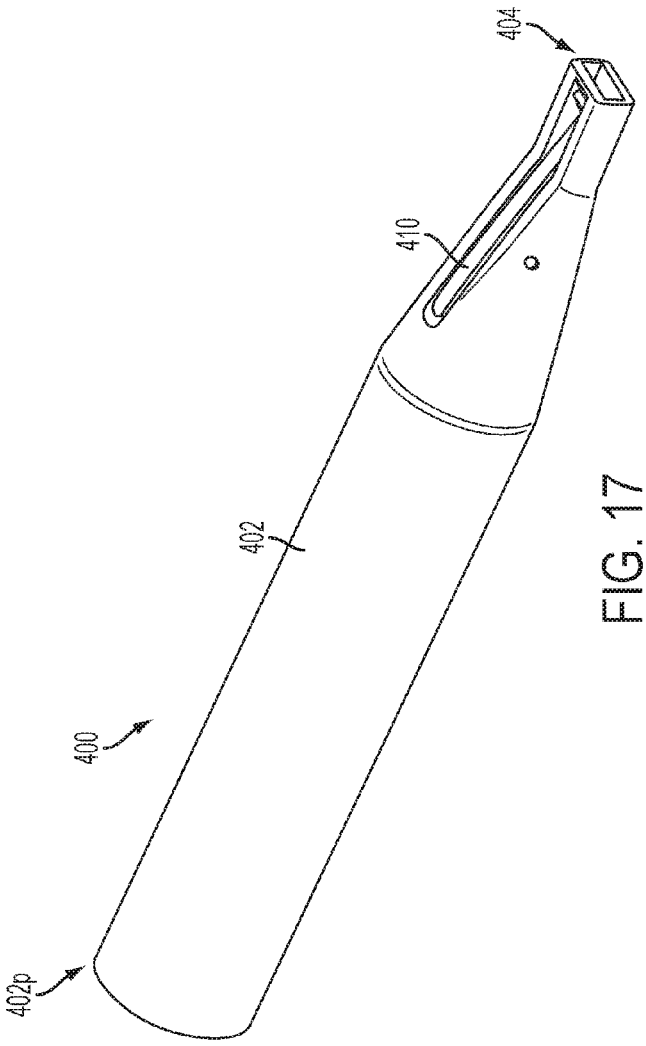

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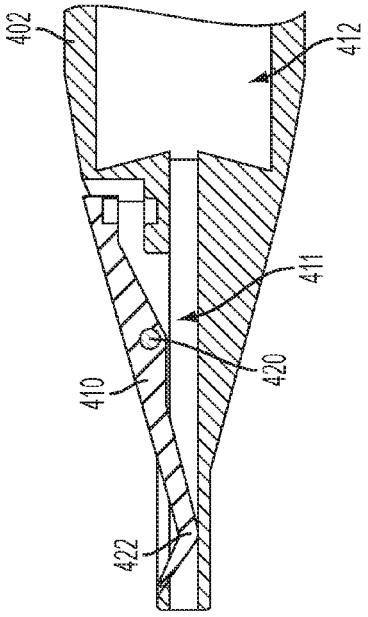

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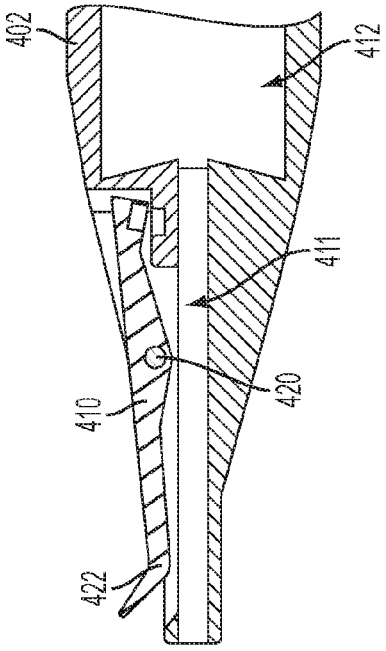

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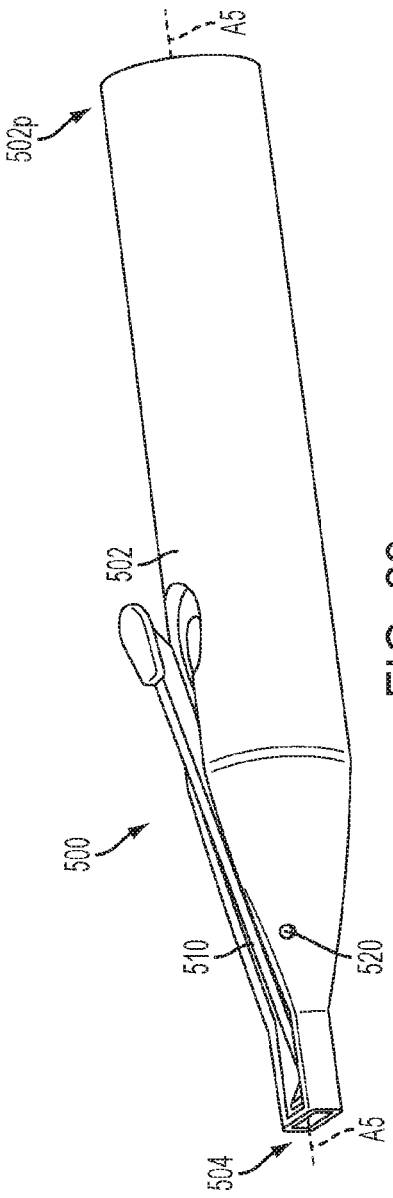

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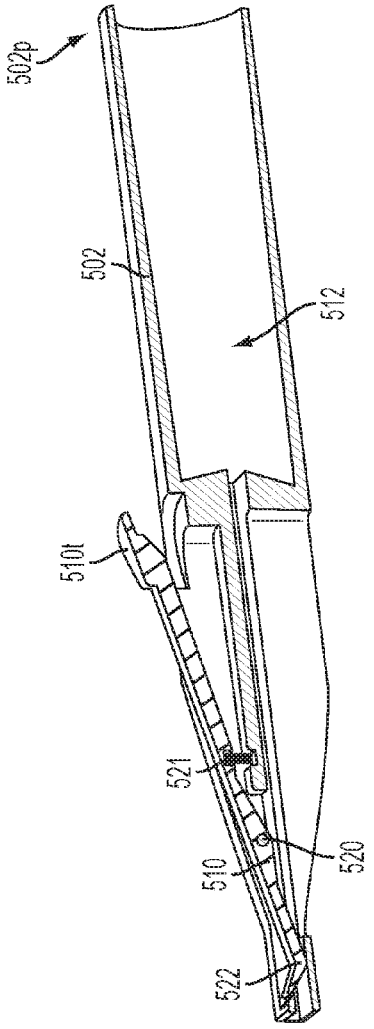

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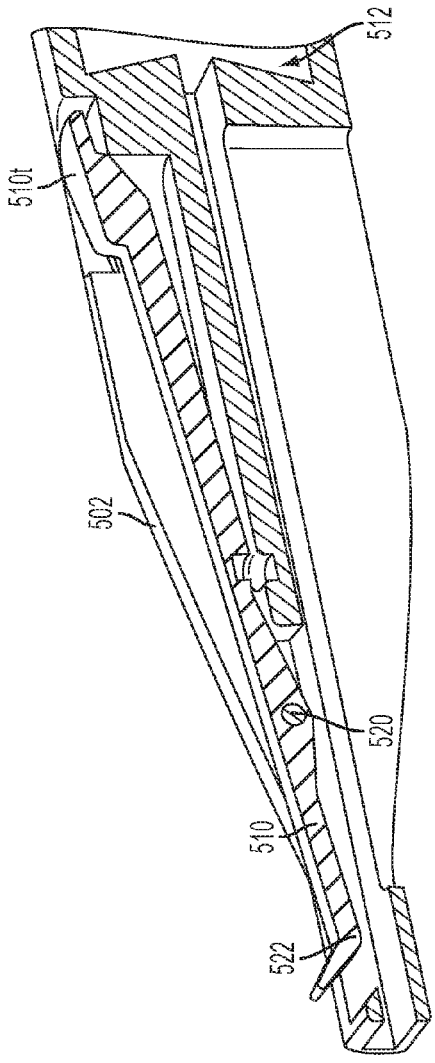

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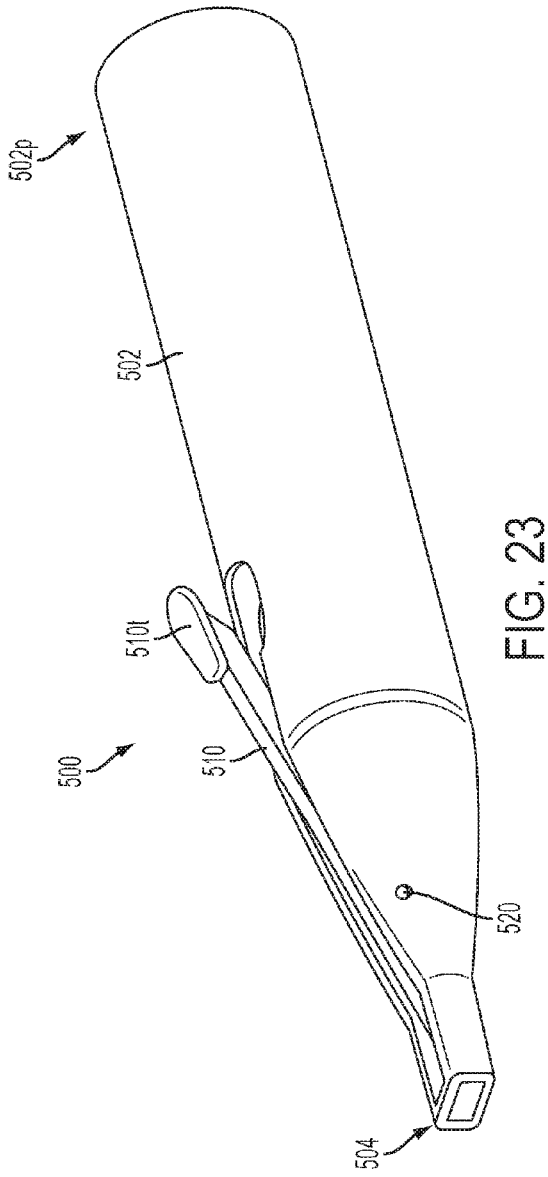

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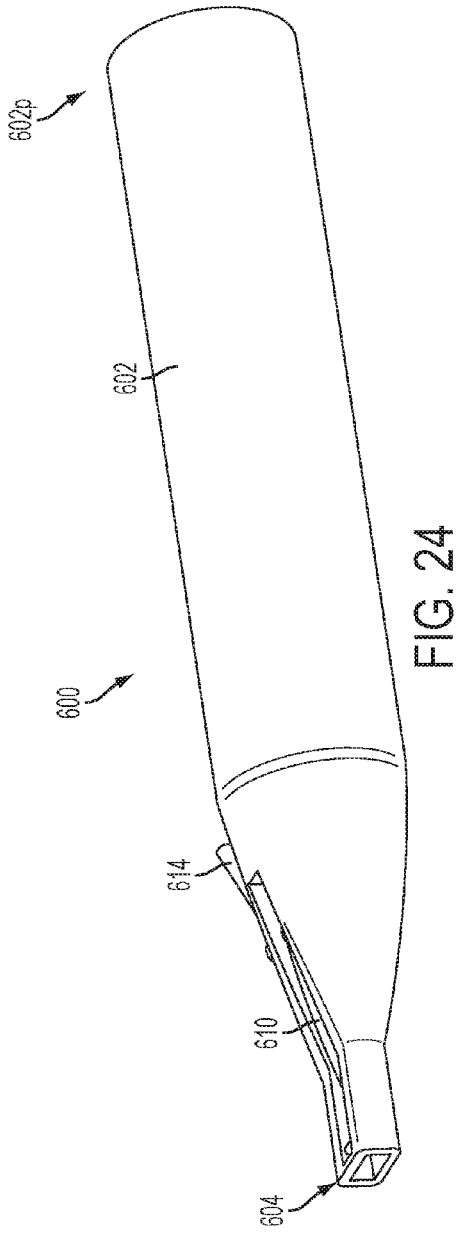
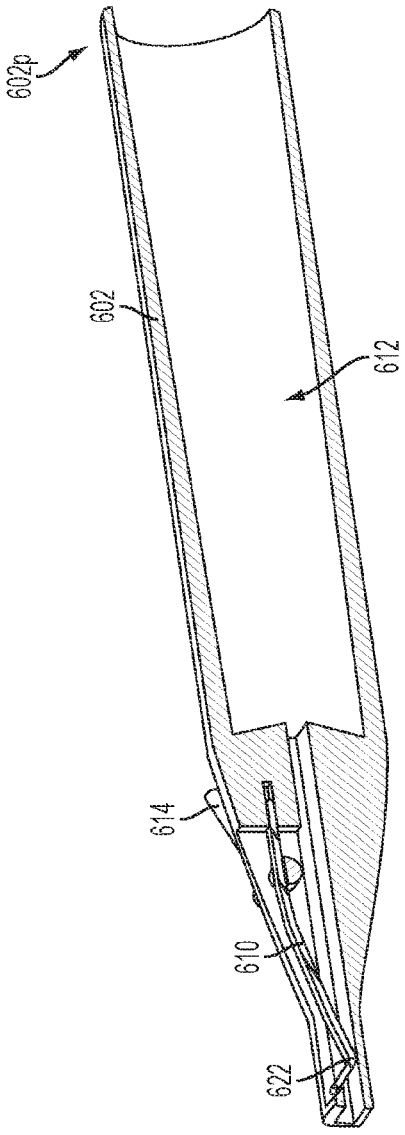


FIG. 24



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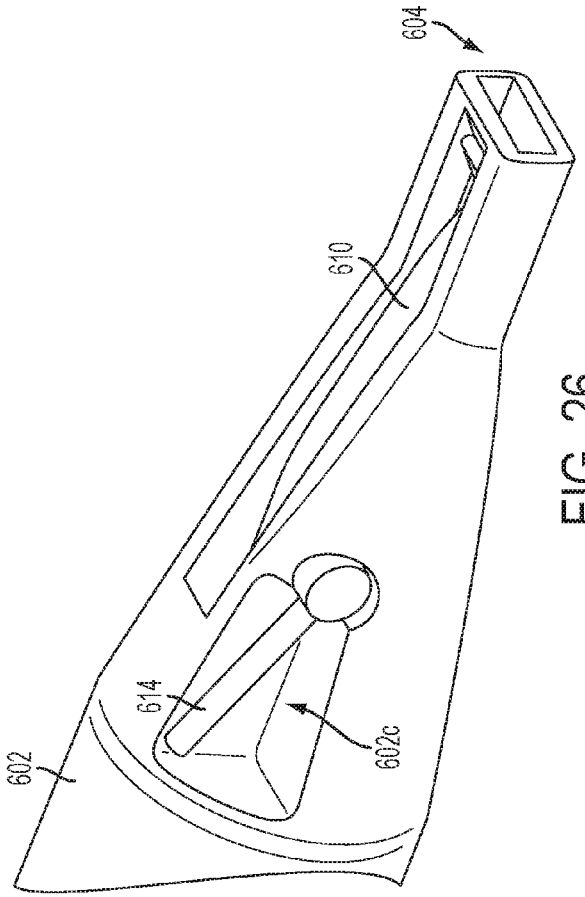

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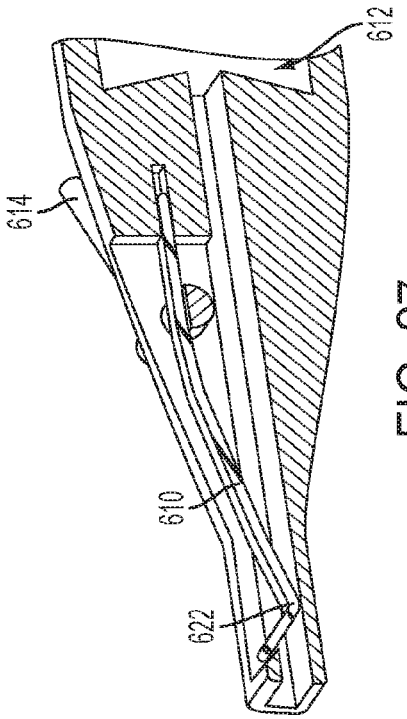

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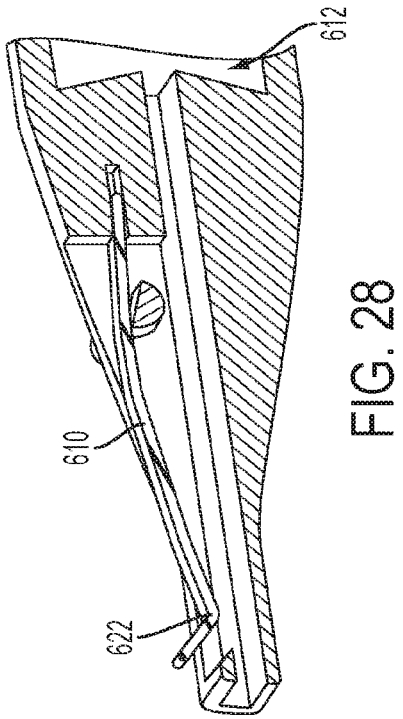

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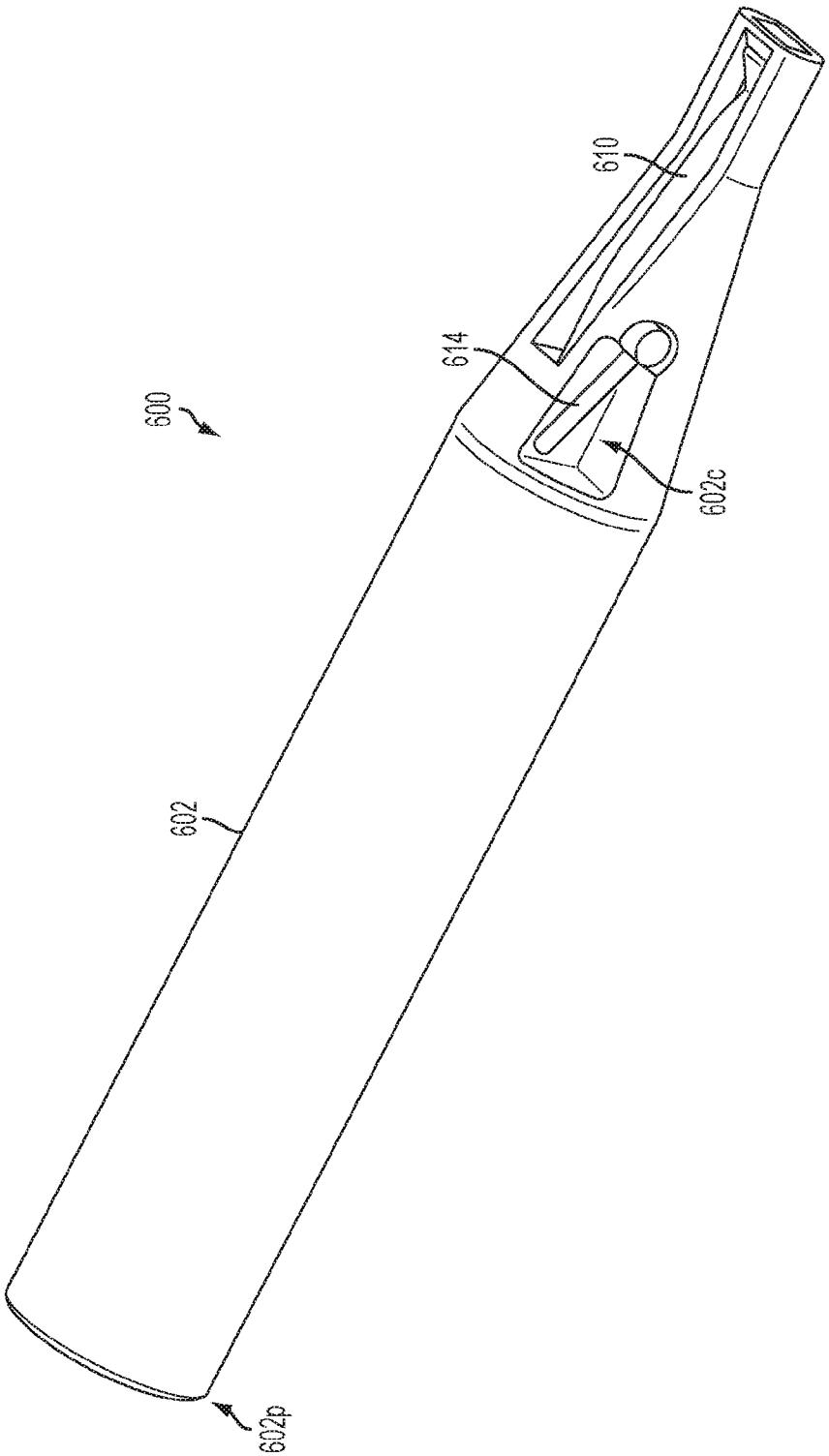

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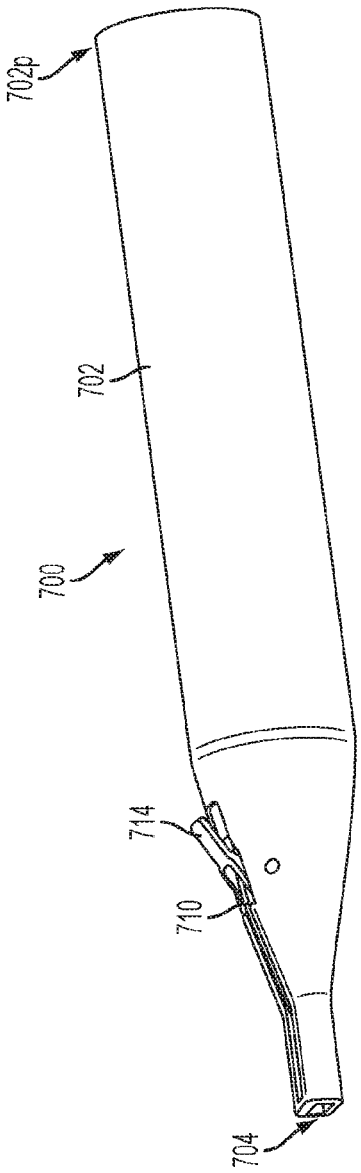

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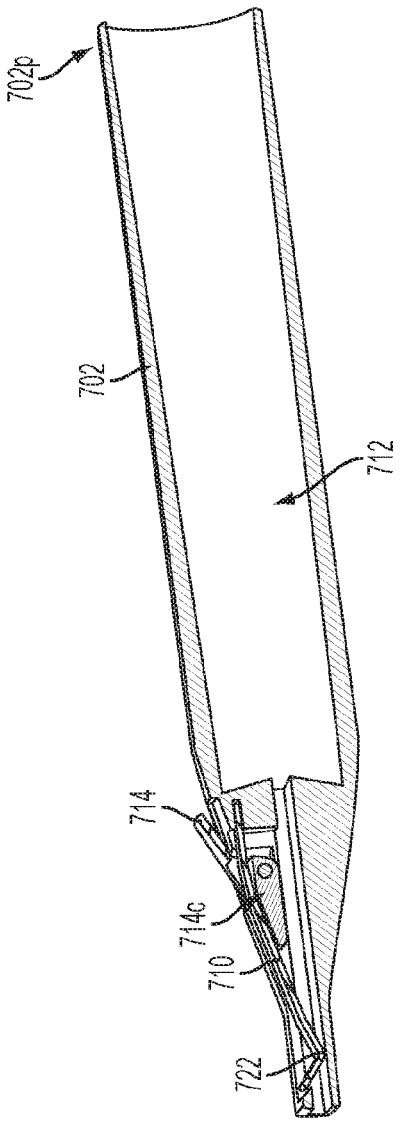

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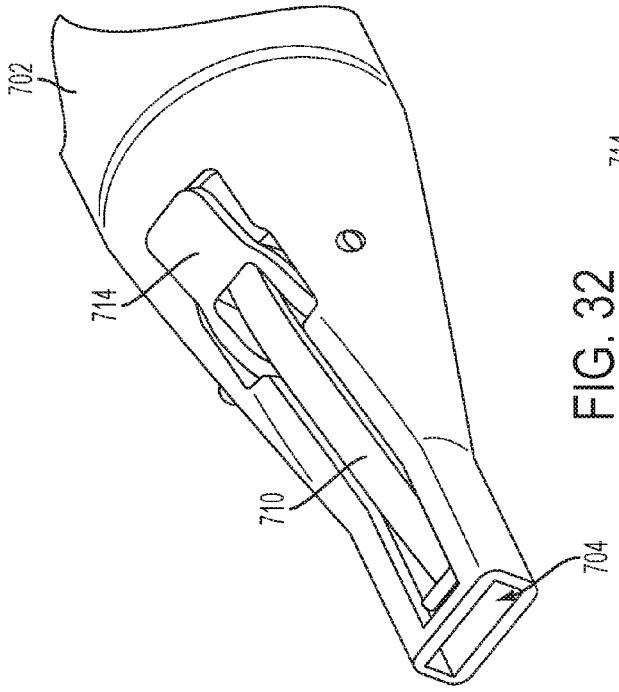

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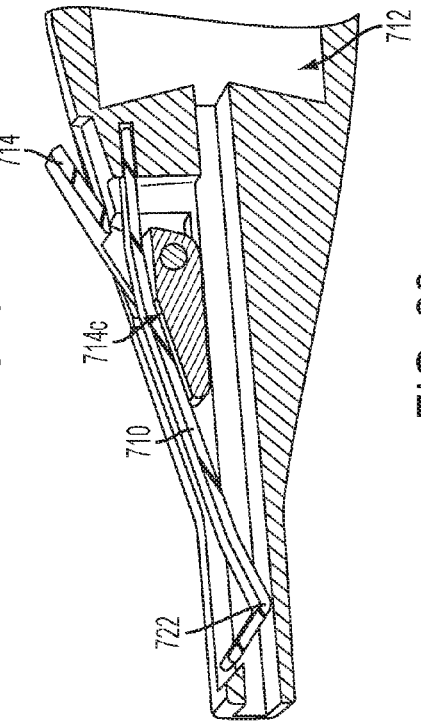

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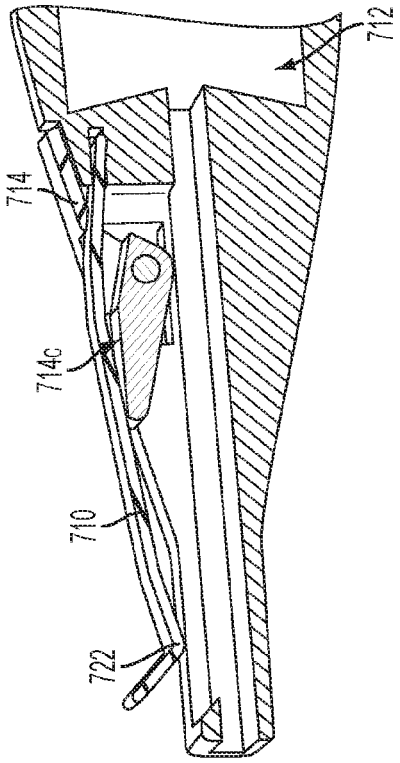
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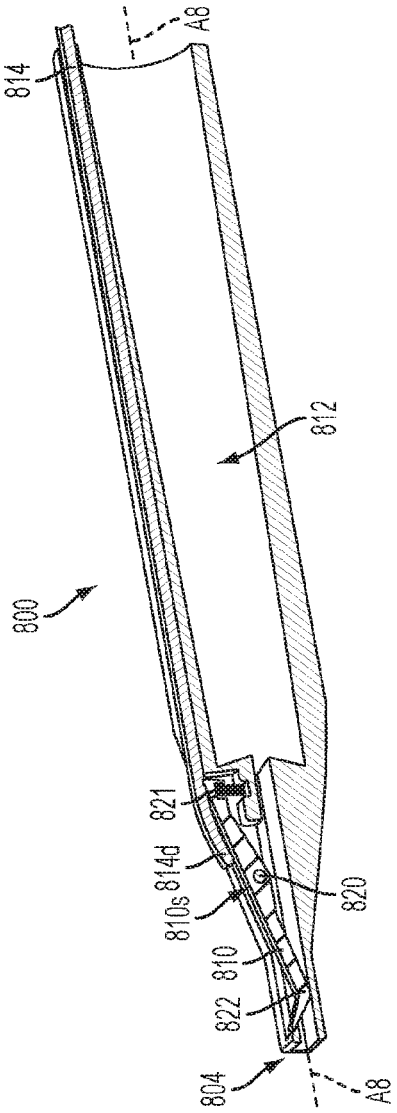
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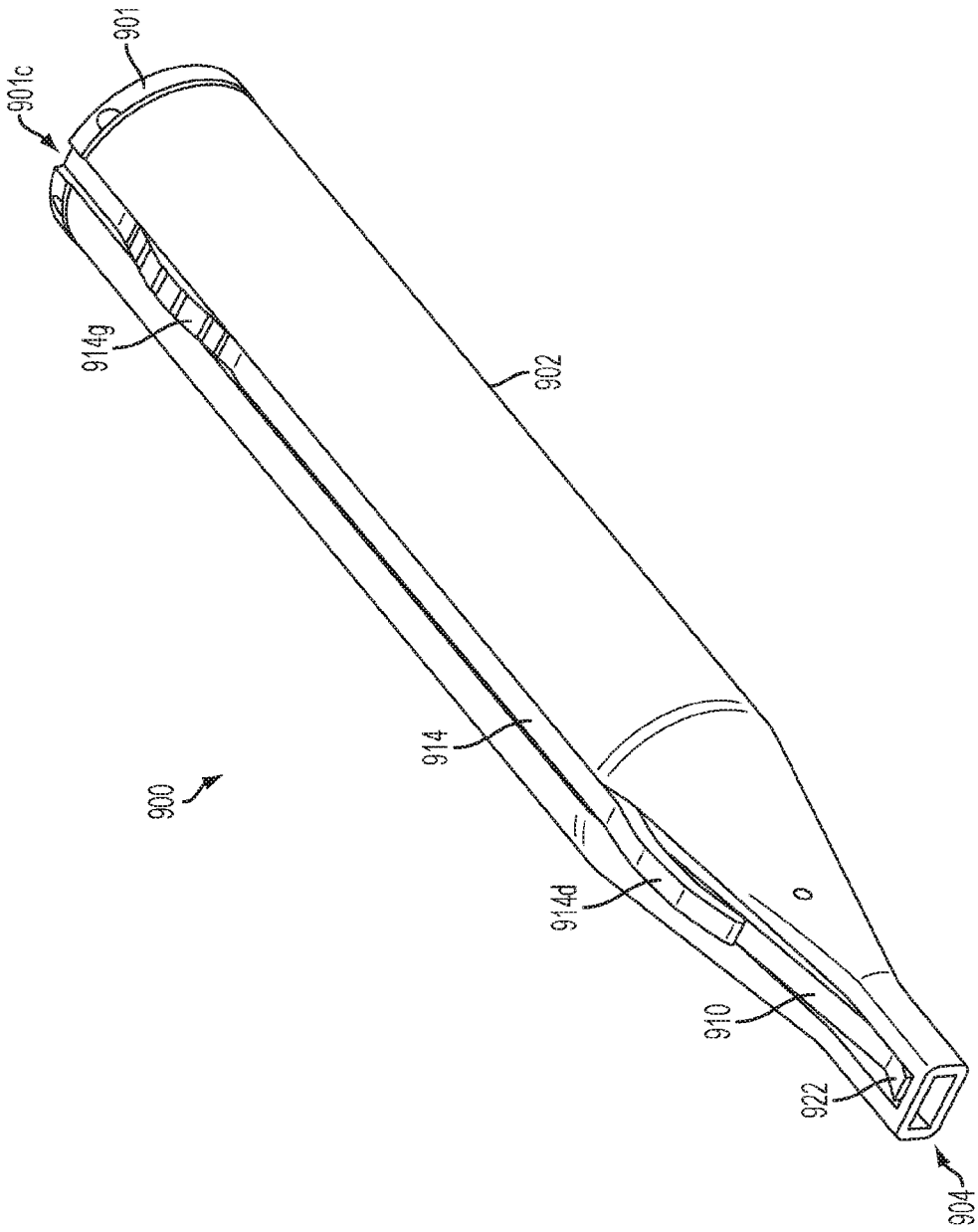

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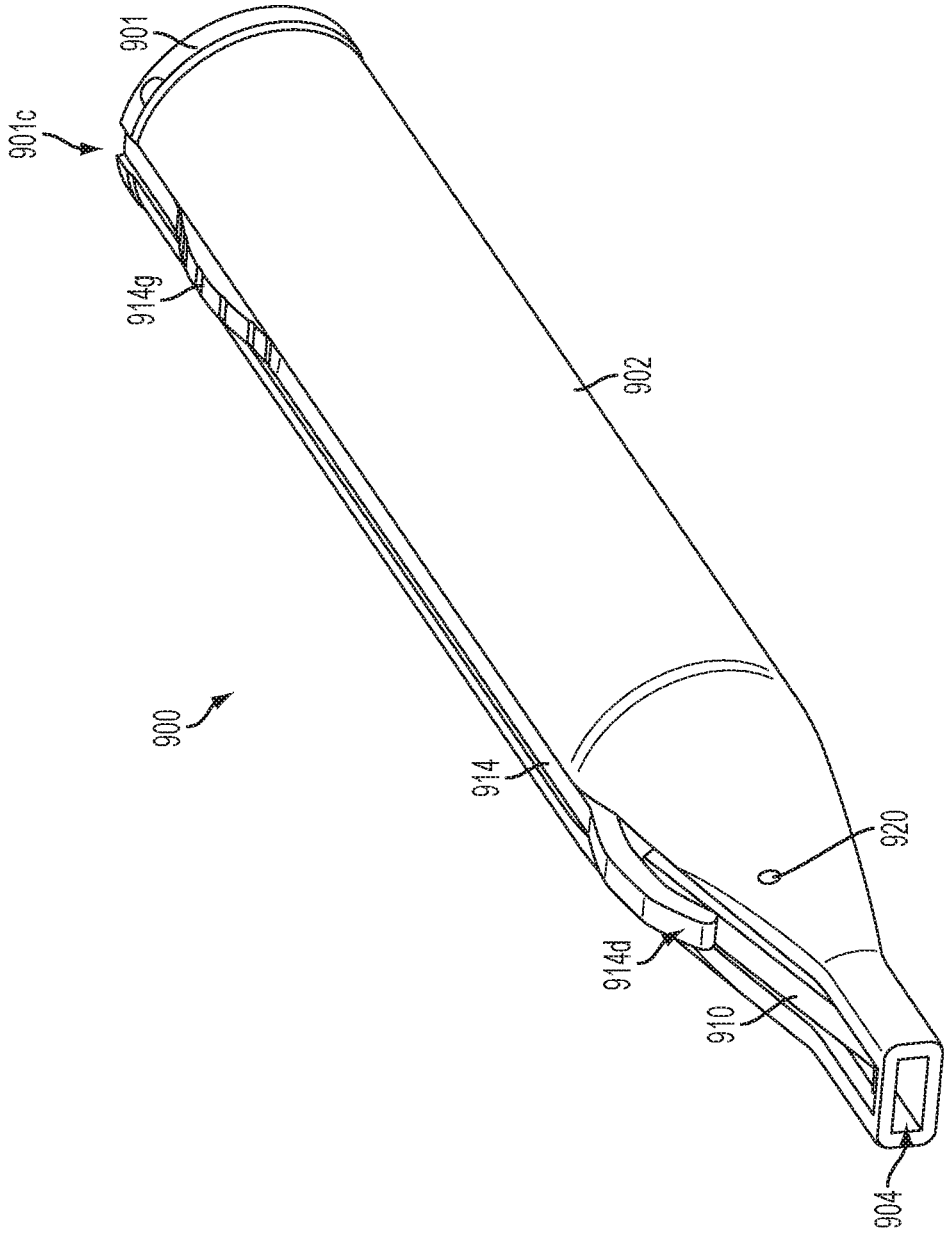

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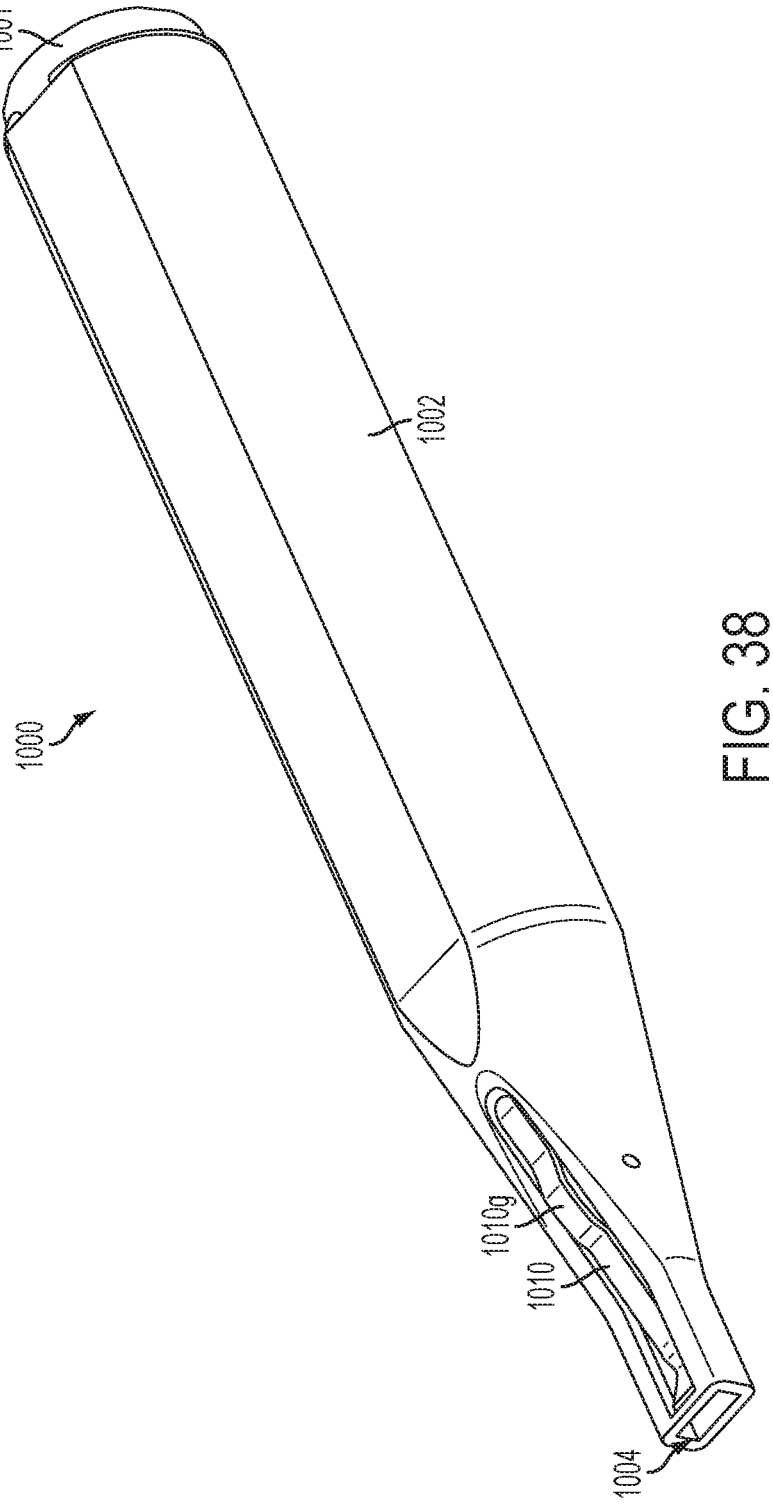

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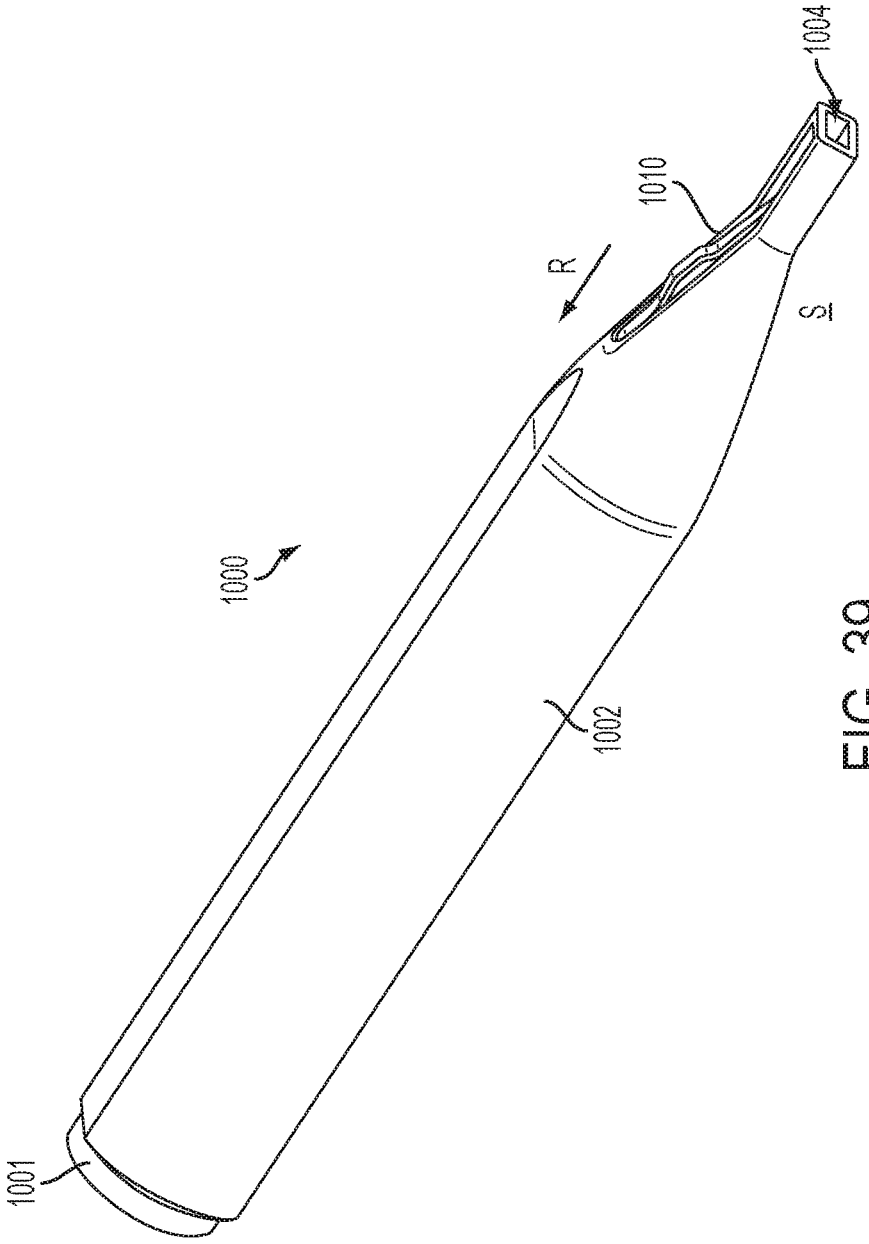


FIG. 39

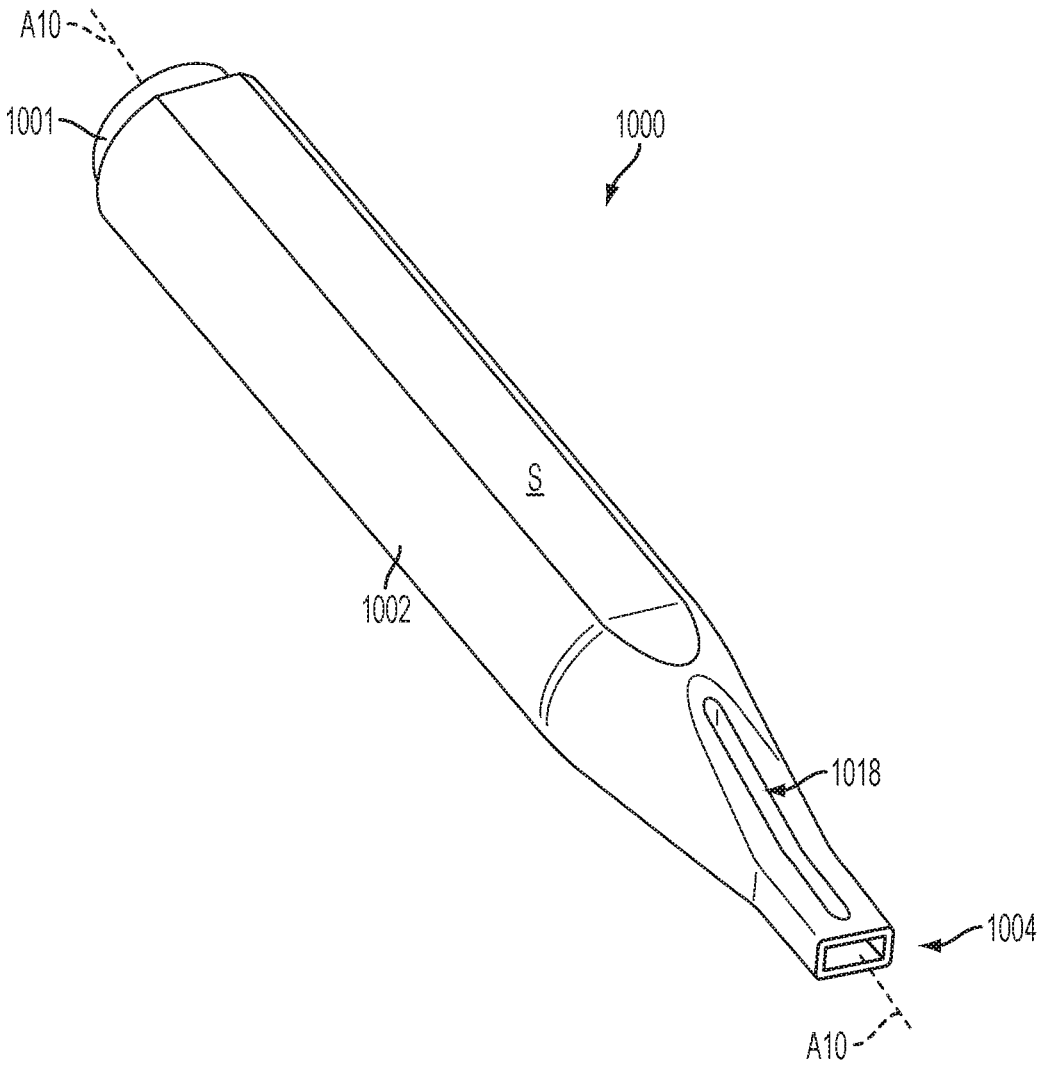
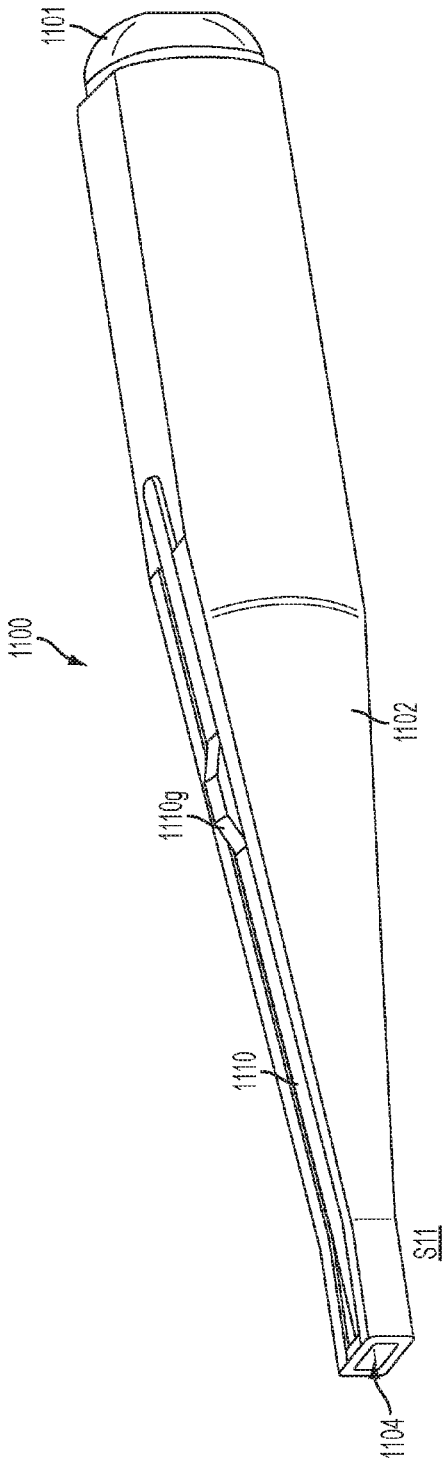


FIG. 40



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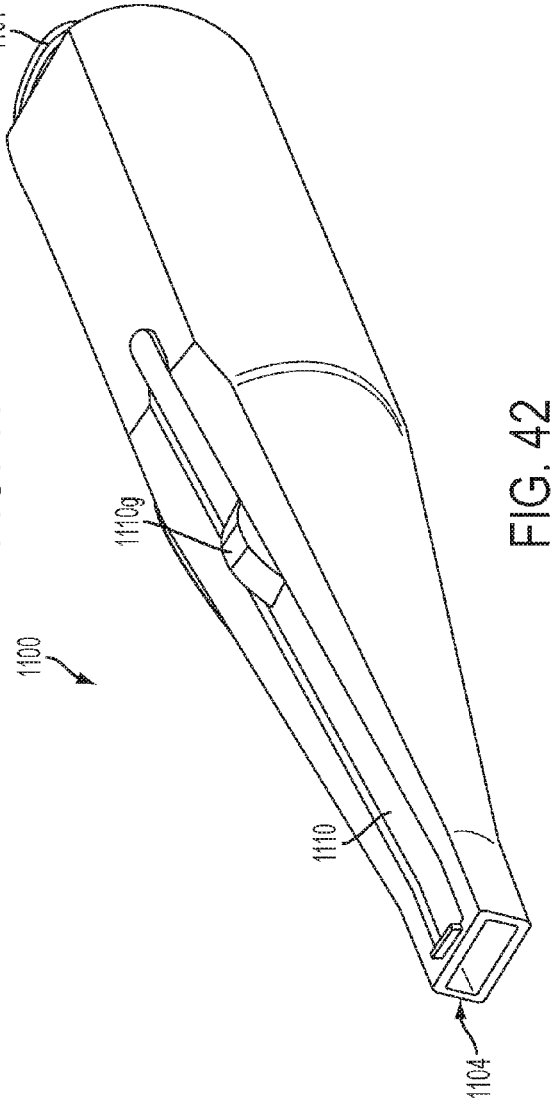

FIG. 42

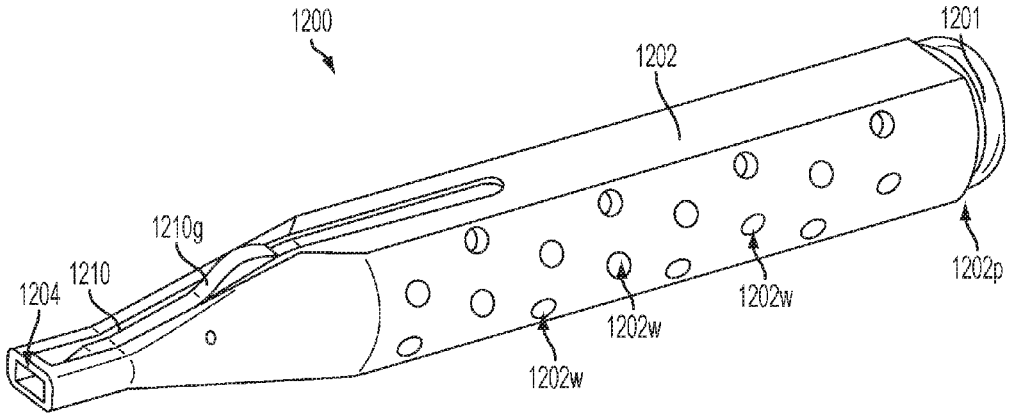
1200
1201
1202
1210g
1210
1204
1202p
1202w
1202w
1202w

FIG. 43

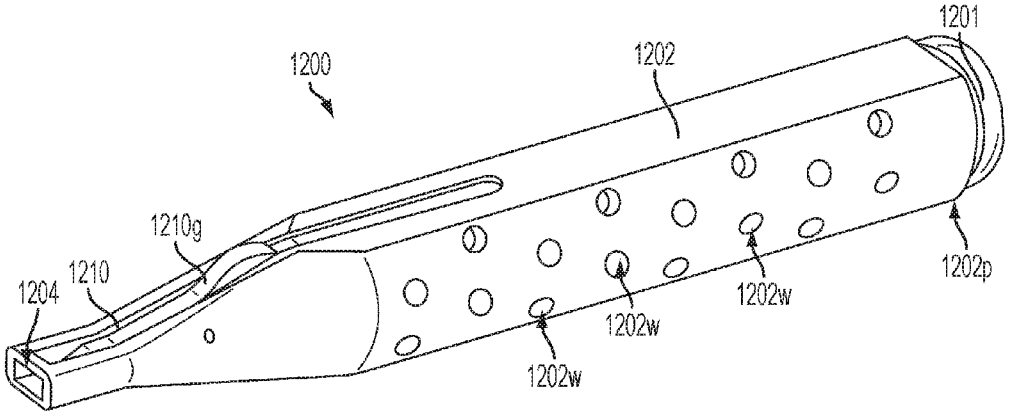
1201
1200
1202
1210g
1210
1204
1202p
1202w
1202w
1202w

FIG. 44

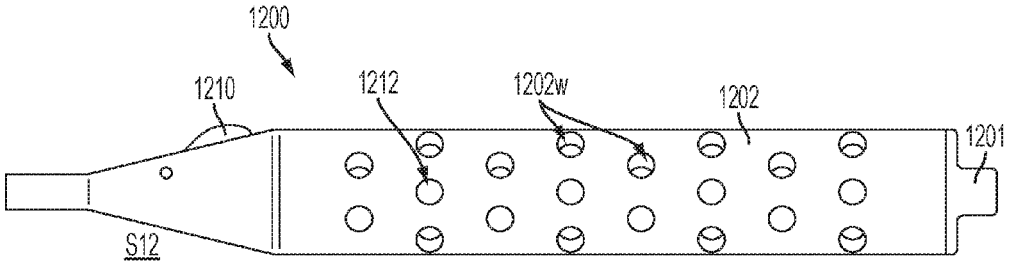

FIG. 45

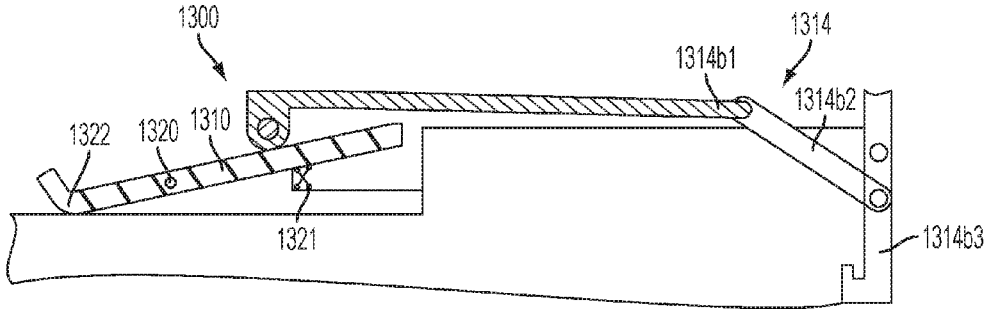

FIG. 46

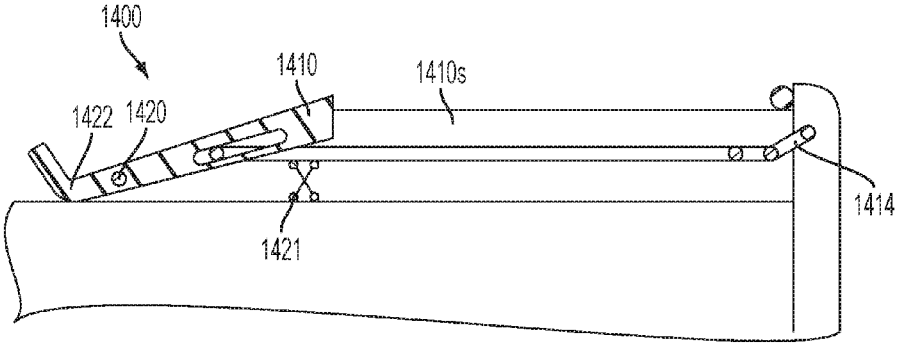

FIG. 47

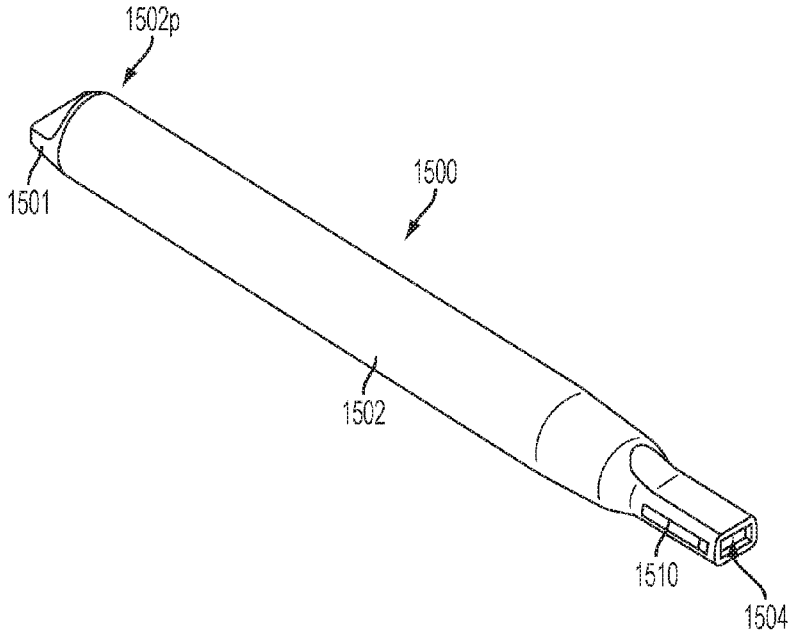

FIG. 48

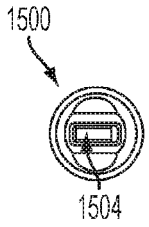

FIG. 49

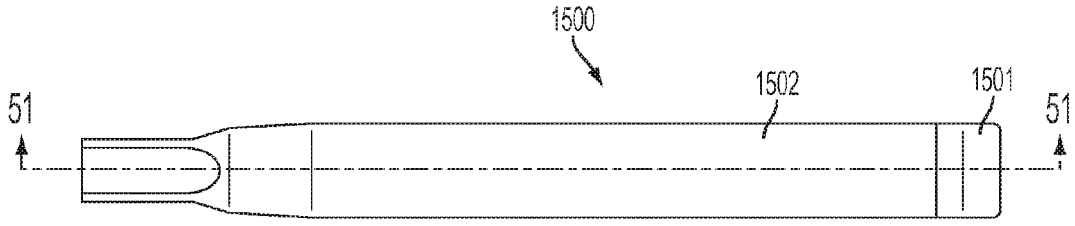

FIG. 50

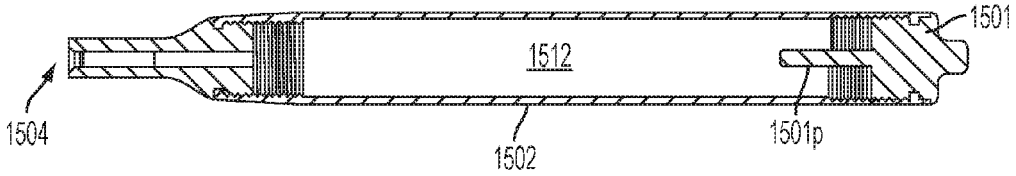

FIG. 51

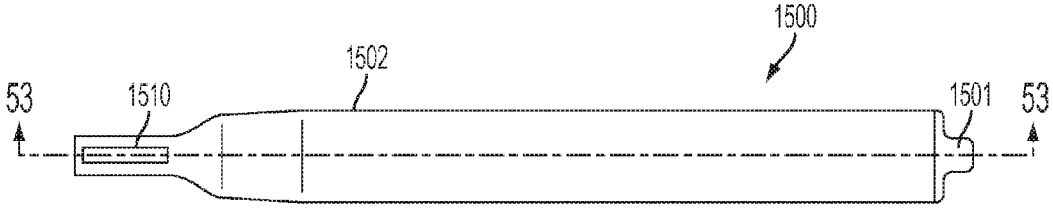

FIG. 52

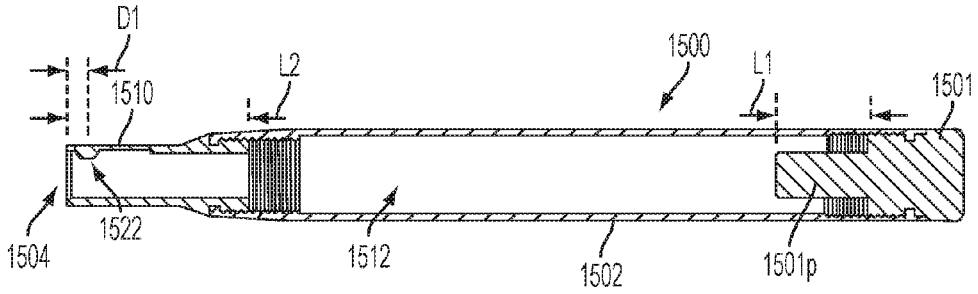

FIG. 53

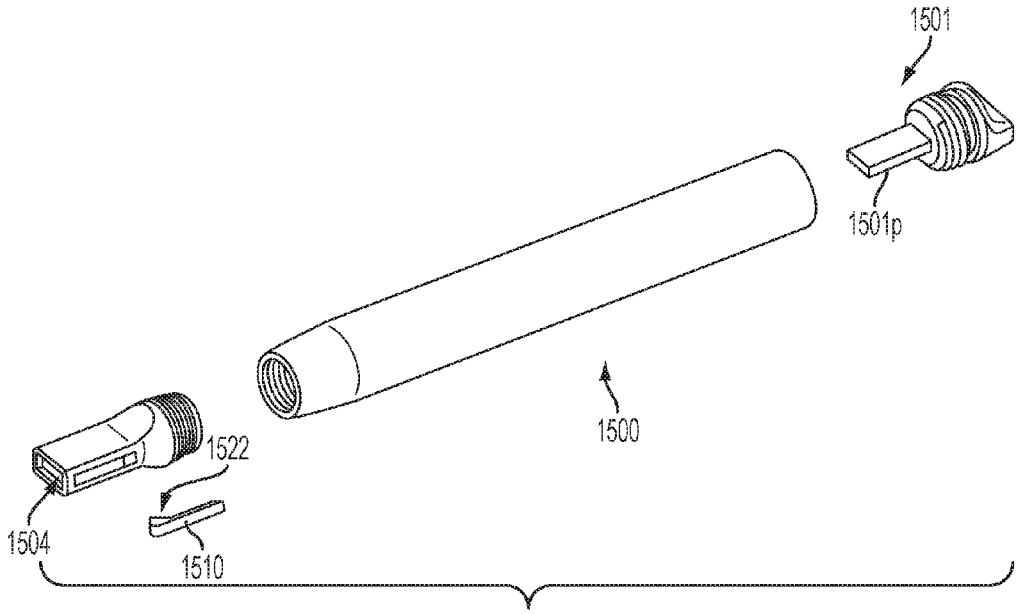

FIG. 54

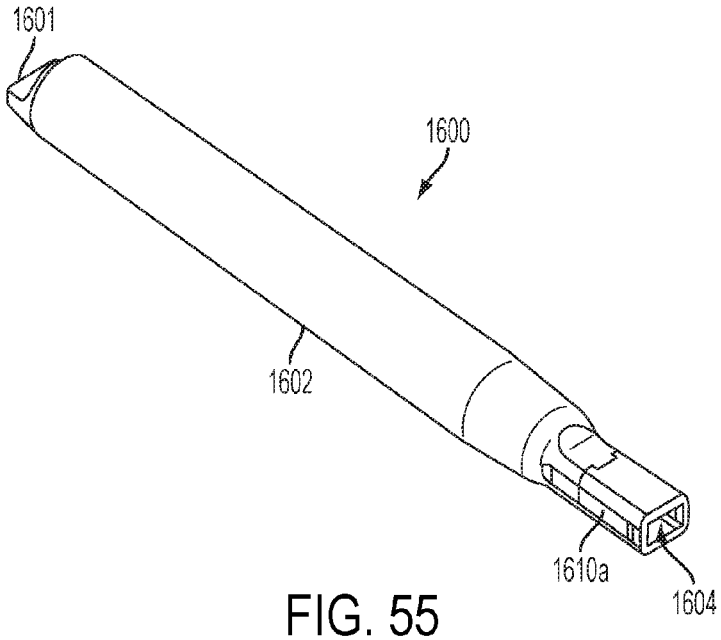

FIG. 55

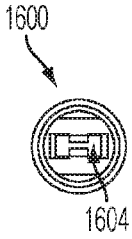

FIG. 56

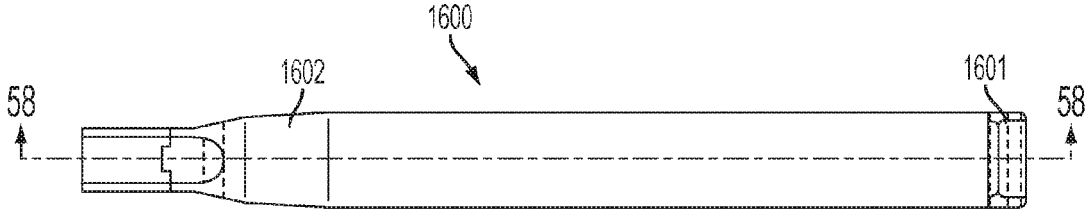

FIG. 57

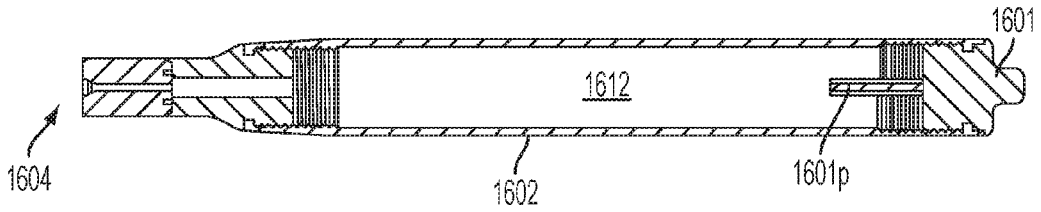

FIG. 58

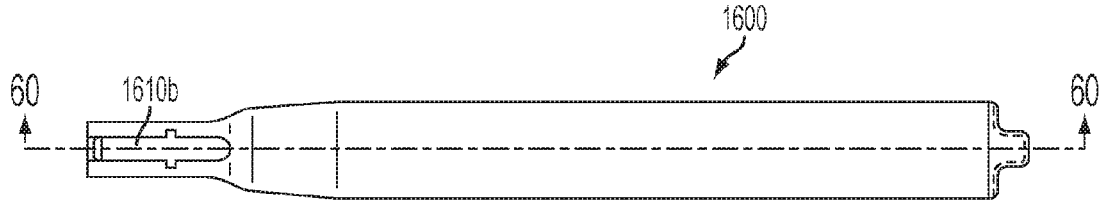

FIG. 59

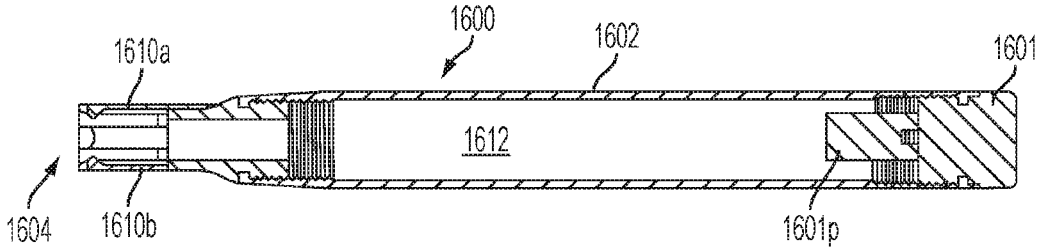

FIG. 60

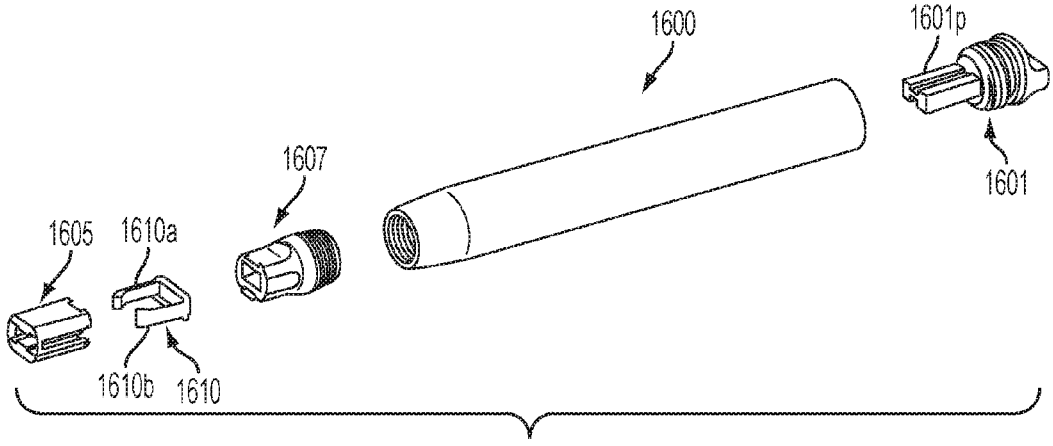

FIG. 61

DEVICES AND METHODS FOR BREAKING AND RETAINING SURGICAL REDUCTION TABS

CROSS REFERENCE TO RELATED APPLICATIONS

The present application claims priority to U.S. Provisional Application No. 61/706,860 entitled "Devices And Methods For Breaking And Retaining Surgical Reduction Tabs" filed on Sep. 28, 2012, which is hereby incorporated by reference in its entirety.

FIELD

The present disclosure relates generally to devices and methods for breaking and retaining surgical reduction tabs.

BACKGROUND

Some types of conventional surgical implants can have one or more reduction tabs extending therefrom. Conventional spinal anchors, for non-limiting example, typically have two opposed reduction tabs extending proximally therefrom. The reduction tabs of a surgical implant can be used in implanting the surgical implant, and then the reduction tabs can be broken off the implanted surgical implant to reduce a clearance height of the surgical implant, which can help prevent the surgical implant from damaging tissue and/or other material adjacent to the implant.

However, conventional devices used to break reduction tabs can only be used to break a small number of reduction tabs, typically one or two, before the device must be reoriented so that an opposite end of the device can be used and/or be removed from a patient and cleared of the broken tab(s) to break off another small number of reduction tabs, typically one or two. It can therefore take a significant amount of time to break all reduction tabs that need to be broken in a surgical procedure, as tens of reductions tabs can be needed to be broken in a single surgical procedure.

Some conventional devices used to break reduction tabs off of an implanted implant cannot retain the broken reduction tabs within the device, thereby leaving broken reduction tabs loose within the patient that need to be removed from the patient prior to ending the surgical procedure. Conventional broken reduction tabs are relatively small, which can make them difficult to retrieve in a patient. Further, since numerous reduction tabs may be broken in a single surgical procedure, it can take a significant amount of time to retrieve all of the loose broken reduction tabs. While some conventional devices used to break reduction tabs off of an implanted implant can retain the broken reduction tabs within the device, only a small number of broken reduction tabs, e.g., four or less or two or less, can be retained within the device before the device has to be replaced during a surgical procedure with another device to break and retain more reduction tabs and/or the device has to be removed from the patient and unloaded of broken tabs before being used to break more reduction tabs. It can therefore take a significant amount of time to break all reduction tabs that need to be broken in a surgical procedure, as tens of reductions tabs can be needed to be broken in a single surgical procedure.

Accordingly, there remains a need for devices and methods for breaking and retaining surgical reduction tabs.

SUMMARY

The present invention generally provides devices and methods for breaking and retaining surgical reduction tabs.

In one aspect, a surgical apparatus is provided that in one embodiment includes an elongate shaft and a retention element disposed at least partially within the shaft. The shaft can have proximal and distal ends, an opening at the distal end of the shaft, and a chamber formed therein proximal to and in communication with the opening. The distal end of the shaft can be configured to be advanced into a body of a patient, and the opening can be configured to receive a reduction tab of a surgical implant. The retention element can be located adjacent the opening and can be configured to hold the retention tab received in the opening in a fixed position relative to the shaft. The shaft can be configured to be manipulated to break the retention tab received in the opening and held by the retention element off from the surgical implant, and the chamber can be configured have the broken reduction tab disposed therein.

The plurality of broken reduction tabs can vary in number. For example, the plurality of broken reduction tabs can be at least five tabs. For example, the plurality of broken reduction tabs can be in a range of five to fifty tabs.

The chamber can be configured to have a plurality of broken reduction tabs simultaneously disposed therein.

The opening can be configured to sequentially receive the reduction tab and a plurality of additional reduction tabs of one or more surgical implants. The retention element can be configured to sequentially hold the reduction tab and each of the plurality of additional reduction tabs in a fixed position relative to the shaft. The shaft can be configured to be manipulated to break each of the plurality of additional retention tabs received in the opening and held by the retention element off of the one or more surgical implants. The chamber can be configured have the reduction tab and each of the broken additional reduction tabs simultaneously disposed therein. A first one of the plurality of reduction tabs can be configured to move the broken reduction tab from the fixed position and into the chamber. Each of a remainder of the plurality of reduction tabs can be configured to move an immediately preceding broken one of the reduction tabs from the fixed position and into the chamber. A first one of the plurality of reduction tabs can be configured to move the broken reduction tab proximally within the shaft. Each of a remainder of the plurality of reduction tabs can be configured to move an immediately preceding broken one of the reduction tabs proximally within the shaft. The plurality of broken reduction tabs can be at least five tabs and/or can be a range of five to fifty tabs.

The retention element can have any number of variations. For example, the retention element can be spring loaded. For another example, the retention element can direct a force toward an interior sidewall of the shaft such that the retention tab received in the opening is held between the retention element and the interior sidewall of the shaft. For yet another example, the retention element can have a pinch point in a distal portion thereof. The pinch point can be disposed adjacent to and proximal to the opening and can be configured to directly contact the retention tab received in the opening so as to hold the retention tab received in the opening in the fixed position. The pinch point can be disposed between the opening and a distal-most end of the chamber. For another example, the retention element can be configured to move between a first configuration in which the retention element is in a first position relative to a longitudinal axis of the shaft and a second configuration in which the retention element is in a second position relative to the longitudinal axis of the shaft. The second position can be radially offset from the first position relative to the longitudinal axis. For still another

example, the retention element can include a bar at least partially disposed within the shaft.

The shaft can have a proximal opening in a proximal portion thereof. The proximal opening can be in communication with the chamber such that any broken retention tabs held in the chamber can be released from the chamber through the proximal opening.

The surgical apparatus can include a release element coupled to the retention element. The release element can be configured to be actuated to cause any broken retention tabs of surgical implants held in the chamber to be released from the chamber through the opening.

The reduction tab of the surgical implant can include a reduction tab extending proximally from a head of a surgical screw having a shank extending distally from the head.

In another embodiment, a surgical apparatus is provided that includes an elongate shaft and a retention element. The shaft can have an opening at a distal end thereof and a chamber formed therein that is in communication with the opening. The opening can be configured to sequentially receive a plurality of breakable extension tabs of one or more surgical implants therein. The shaft can be configured to be manipulated to sequentially break each of the breakable extension tabs off the one or more surgical implants. The chamber can be configured to retain each of the breakable extension tabs therein after the breakable extension tabs have been broken off the one or more surgical implants by manipulating the shaft. The retention element can be disposed at least partially within the shaft and located adjacent the opening. The retention element can be configured to sequentially engage each of the breakable extension tabs received in the opening within the shaft before the shaft is manipulated to sequentially break each of the breakable extension tabs off the one or more surgical implants. The retention element can be configured to hold within the shaft each of the breakable extension tabs after having been broken off the one or more surgical implants by manipulating the shaft.

Each of the broken breakable extension tabs except a last one of the broken breakable extension tabs can be displaced from being held by the retention element by a subsequent one of the breakable extension tabs received in the opening so as to sequentially advance each of the broken breakable extension tabs except the last one of the broken breakable extension tabs into the chamber.

The chamber can be configured to have a plurality of breakable extension tabs simultaneously disposed therein. The plurality of broken breakable extension tabs can be at least five tabs and/or can be in a range of five to fifty tabs.

The opening can be configured to sequentially receive the breakable extension tab and a plurality of additional breakable extension tabs of one or more surgical implants. The retention element can be configured to sequentially hold the breakable extension tab and each of the plurality of additional breakable extension tabs in a fixed position relative to the shaft. The shaft can be configured to be manipulated to break each of the plurality of additional breakable extension tabs received in the opening and held by the retention element off of the one or more surgical implants. The chamber can be configured have the breakable extension tab and each of the broken additional breakable extension tabs simultaneously disposed therein. A first one of the plurality of breakable extension tabs can be configured to move the broken breakable extension tab from the fixed position and into the chamber, and each of a remainder of the plurality of breakable extension tabs can be configured to move an immediately preceding broken one of the breakable extension tabs from the fixed position and into the chamber. A first one of the plurality of breakable extension tabs can be configured to move the broken breakable extension tab proximally within the shaft, and each of a remainder of the plurality of reduction tabs being configured to move an immediately preceding broken one of the breakable extension tabs proximally within the shaft. The plurality of broken breakable extension tabs can be at least five tabs and/or can be in a range of five to fifty tabs.

The retention element can have any number of variations. For example, the retention element can be spring loaded. For another example, the retention element can direct a force toward an interior sidewall of the shaft such that the breakable extension tab received in the opening is held between the retention element and the interior sidewall of the shaft. For yet another example, the retention element can have a pinch point in a distal portion thereof. The pinch point can be configured to directly contact the breakable extension tab received in the opening so as to hold the breakable extension tab received in the opening in the fixed position. The pinch point can be disposed between the opening and a distal-most end of the chamber. For another example, the retention element can be configured to move between a first configuration in which the retention element is in a first position relative to a longitudinal axis of the shaft and a second configuration in which the retention element is in a second position relative to the longitudinal axis of the shaft. The second position can be radially offset from the first position relative to the longitudinal axis. For still another example, the retention element can include a bar at least partially disposed within the shaft.

The shaft can have a proximal opening in a proximal portion thereof. The proximal opening can be in communication with the chamber such that any broken breakable extension tabs of surgical implants held in the chamber can be released from the chamber through the proximal opening.

The apparatus can include a release element coupled to the retention element. The release element can be configured to be actuated to cause any broken breakable extension tabs held in the chamber to be released from the chamber through the opening.

The apparatus of claim **20**, wherein the breakable extension tab of the surgical implant comprises a breakable extension tab extending proximally from a head of a surgical screw having a shank extending distally from the head.

In another aspect, a surgical kit is provided that includes a surgical apparatus, e.g., any of the surgical apparatuses described herein. In one embodiment, the kit can include a plurality of surgical implants each having at least one reduction tab configured to be disposed within an opening of a shaft of the apparatus, broken by manipulating the shaft, and simultaneously retained in a chamber of the apparatus.

In another aspect, a surgical method is provided that includes disposing a first reduction tab of a first surgical implant implanted within a patient within an opening at a distal end of an elongate shaft such that a retention element disposed at least partially within the shaft engages the first reduction tab, manipulating the shaft to break the first reduction tab disposed within the opening off of the first surgical implant, retaining the broken first reduction tab within the shaft by the retention element holding the broken first reduction tab in a fixed position relative to the shaft, disposing a second reduction tab of a second surgical implant implanted within the patient within the opening such that the retention element engages the second reduction tab, manipulating the shaft to break the second reduction tab disposed within the opening off of the second surgical implant, and retaining the broken second reduction tab within the shaft such that the broken first and second reduction tabs are simultaneously retained within the shaft.

The method can vary in any number of ways. For example, disposing the second reduction tab within the opening can move the broken first reduction tab from being held in the fixed position relative to the shaft to being disposed within a chamber formed in the shaft. For another example, disposing the second reduction tab within the opening can move the broken first reduction tab proximally within the shaft. For yet another example, disposing the second reduction tab within the opening can cause the broken first reduction tab to be loosely disposed within the chamber. For another example, the retention element can retain the broken first reduction tab within the shaft by applying a spring force thereto, and the retention element can retain the broken second reduction tab within the shaft by applying a spring force thereto. For still another example, the method can include sequentially disposing a plurality of additional reduction tabs of at least one additional surgical implant implanted within the patient within the opening such that the retention element sequentially engages each of the plurality of additional reduction tabs, manipulating the shaft to sequentially break each of the plurality of additional reduction tabs disposed within the opening off of the at least one additional surgical implant, and retaining each of the broken plurality of additional reduction tabs within the shaft such that the broken first and second reduction tabs and the broken plurality of additional reduction tabs are simultaneously retained within the shaft.

BRIEF DESCRIPTION OF DRAWINGS

This invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a perspective view of one embodiment of a surgical instrument configured to break and retain surgical reduction tabs, the instrument having a reduction tab attached to an implant inserted in an opening formed in a distal end of the instrument;

FIG. **2** is a cross-sectional view of the instrument of FIG. **1**;

FIG. **3** is a distal end view of the instrument of FIG. **1**;

FIG. **4** is a partial cross-sectional view of the instrument of FIG. **1**;

FIG. **5** is a another partial cross-sectional view of the instrument of FIG. **1**;

FIG. **6** is a cross-sectional view of the instrument of FIG. **1** having the reduction tab disposed therein, the reduction tab having been broken off the implant;

FIG. **7** is another cross-sectional view of the instrument of FIG. **1** having the reduction tab disposed therein, the reduction tab having been broken off the implant;

FIG. **8** is a perspective view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **9** is a cross-sectional view of the instrument of FIG. **8**;

FIG. **10** is a partial cross-sectional view of the instrument of FIG. **8**;

FIG. **11** is a perspective view of yet another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **12** is a cross-sectional view of the instrument of FIG. **11**;

FIG. **13** is a partial cross-sectional view of the instrument of FIG. **11**;

FIG. **14** is a partial perspective view of the instrument of FIG. **11**;

FIG. **15** is a perspective view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **16** is a cross-sectional view of the instrument of FIG. **15**;

FIG. **17** is another perspective view of the instrument of FIG. **15**;

FIG. **18** is a partial cross-sectional view of the instrument of FIG. **15**;

FIG. **19** is another partial cross-sectional view of the instrument of FIG. **15**;

FIG. **20** is a perspective view of still another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **21** is a cross-sectional view of the instrument of FIG. **20**;

FIG. **22** is a partial cross-sectional view of the instrument of FIG. **20**;

FIG. **23** is another perspective view of the instrument of FIG. **20**;

FIG. **24** is a perspective view of yet another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **25** is a cross-sectional view of the instrument of FIG. **24**;

FIG. **26** is a partial perspective view of the instrument of FIG. **24**;

FIG. **27** is a partial cross-sectional view of the instrument of FIG. **24**;

FIG. **28** is another partial cross-sectional view of the instrument of FIG. **24**;

FIG. **29** is another perspective view of the instrument of FIG. **24**;

FIG. **30** is a perspective view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **31** is a cross-sectional view of the instrument of FIG. **30**;

FIG. **32** is a partial perspective view of the instrument of FIG. **30**;

FIG. **33** is a partial cross-sectional view of the instrument of FIG. **30**;

FIG. **34** is another partial cross-sectional view of the instrument of FIG. **30**;

FIG. **35** is a cross-sectional view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **36** is a perspective view of yet another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **37** is another perspective view of the instrument of FIG. **36**;

FIG. **38** is a perspective view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **39** is another perspective view of the instrument of FIG. **38**;

FIG. **40** is yet another perspective view of the instrument of FIG. **38**;

FIG. **41** is a perspective view of still another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **42** is another perspective view of the instrument of FIG. **41**;

FIG. **43** is a perspective view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **44** is another perspective view of the instrument of FIG. **43**;

FIG. **45** is still another perspective view of the instrument of FIG. **43**;

FIG. **46** is a partial cross-sectional view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **47** is a partial cross-sectional view of yet another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **48** is a perspective view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **49** is a distal end view of the instrument of FIG. **48**;

FIG. **50** is a side view of the instrument of FIG. **48**;

FIG. **51** is a cross-sectional view of the instrument of FIG. **50**;

FIG. **52** is another side view of the instrument of FIG. **48**;

FIG. **53** is a cross-sectional view of the instrument of FIG. **52**;

FIG. **54** is an exploded view of the instrument of FIG. **48**;

FIG. **55** is a perspective view of another embodiment of a surgical instrument configured to break and retain surgical reduction tabs;

FIG. **56** is a distal end view of the instrument of FIG. **55**;

FIG. **57** is a side view of the instrument of FIG. **55**;

FIG. **58** is a cross-sectional view of the instrument of FIG. **57**;

FIG. **59** is another side view of the instrument of FIG. **55**;

FIG. **60** is a cross-sectional view of the instrument of FIG. **59**; and

FIG. **61** is an exploded view of the instrument of FIG. **55**.

DETAILED DESCRIPTION

Certain exemplary embodiments will now be described to provide an overall understanding of the principles of the structure, function, manufacture, and use of the devices and methods disclosed herein. One or more examples of these embodiments are illustrated in the accompanying drawings. Those skilled in the art will understand that the devices and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary embodiments and that the scope of the present invention is defined solely by the claims. The features illustrated or described in connection with one exemplary embodiment may be combined with the features of other embodiments. Such modifications and variations are intended to be included within the scope of the present invention.

Various devices and methods are provided for breaking and retaining surgical reduction tabs. In general, the devices and methods can allow a single surgical instrument to break a plurality of surgical reduction tabs off one or more surgical implants and retain the broken tabs within the instrument. Surgical reduction tabs are also referred to herein as "breakable extension tabs."

In an exemplary embodiment, a surgical instrument can include an opening at a distal end thereof that is configured to receive a first surgical reduction tab therein when the first tab is connected to a surgical implant. A retention element at least partially disposed within the surgical instrument can be configured to engage the first tab received in the opening so as to hold the first tab securely within the instrument. With the first tab received in the opening and held by the retention element, the surgical instrument can be configured to be manipulated to break the first tab off the surgical implant, such as by rotating the surgical instrument and/or angling the surgical instrument relative to the surgical implant. The broken first tab can be retained within the surgical instrument by being held therein by the retention element. The surgical instrument can then be relocated, and a second surgical reduction tab of either the same surgical implant or a different surgical implant can be advanced into the opening at the instrument's distal end without the need to change the orientation of the surgical instrument. The second tab can displace the broken first tab from the retention element such that the broken first tab moves proximally within the instrument into a chamber formed in the surgical instrument, and the retention element can securely hold the second tab. The surgical instrument can be configured to be manipulated to break the second tab off its associated surgical implant, with the retention element holding the broken second tab so as to retain the broken second tab within the instrument already having the broken first tab retained therein. The instrument can be repeatedly relocated and repeatedly break off surgical reduction tabs of one or more surgical implants, with each successive tab received in the opening, e.g., on a same distal side of the instrument, displacing the immediately preceding broken tab from the retention element such that the chamber can simultaneously hold a plurality of broken tabs, e.g., up to fifty tabs, within the instrument.

The instrument can thus simultaneously retain a plurality of broken tabs therein, which can allow the instrument to break off multiple tabs without the instrument having to be removed from a patient's body to allow removal of broken tabs from the instrument before using the instrument to break off more tabs, which can save time since a single surgical procedure can include breaking off numerous tabs from one or more surgical implants. Also, since the instrument can be configured to receive each of the tabs in a same opening thereof, e.g., the distal end opening, the instrument need not be turned over or otherwise repositioned within a surgeon's hand during tab breaking, which can save time, since multiple tabs are typically successively broken near an end of a surgical procedure, and/or can be less cumbersome to use than instruments that must be turned over or repositioned within a surgeon's hand for the instrument to effectively break off multiple tabs.

The instrument can include a release mechanism configured to allow release of broken tabs retained therein from the instrument. The instrument can thus be configured to be reused with a same patient during a single surgical procedure if the instrument retains, or approaches retaining, a maximum number of broken tabs therein. The release mechanism can allow removal of the maximum number, or near maximum number, of broken tabs therefrom, thereby allowing the instrument to continue being used to break and retain tabs in the single surgical procedure, which can save time and can reduce a number of instruments used in the surgical procedure, which can reduce operating room clutter and/or reduce monetary cost. The instrument can also be configured to be reused with different patients in different surgical procedures by removing broken tabs therefrom using the release mechanism and then processing the instrument for reuse by cleaning, decontaminating, sterilizing, etc. the instrument in any one or more ways, as will be appreciated by a person skilled in the art.

Various types of surgical implants can include surgical reduction tabs, such as a head of a spinal anchor, e.g., a spinal screw, configured to seat a spinal fixation element, e.g., a spinal rod, therein. In the case of a spinal anchor, two surgical reduction tabs can extend proximally from opposed sides of a head of the spinal fastening member, and a spinal fastening member, e.g., a shank, can extend distally from the head. One embodiment of a spinal anchor including reduction tabs is the EXPEDIUM® Favored Angle Screw available from DePuy

Synthes Spine, Inc. of Raynham, Mass. Various embodiments of spinal anchor assemblies including reduction tabs are further discussed in U.S. Pat. No. 6,755,829 entitled "Lock Cap Anchor Assembly For Orthopaedic Fixation" issued Jun. 29, 2004, which is hereby incorporated by reference in its entirety. However, as mentioned above, the surgical instruments disclosed herein can be used with any type of surgical implant that has one or more breakable extension tabs extending therefrom that are configured to be broken off the surgical implant, e.g., to be broken off after the surgical implant has been implanted in a patient's body and the tab(s) are no longer needed to facilitate implantation of the implant.

The surgical instruments disclosed herein can be formed of one or more materials. In an exemplary embodiment, the one or more materials are biocompatible so as to be safe for use in surgery. In an exemplary embodiment, the one or more materials can be rigid, e.g., stainless steel, titanium, etc., which can help the instrument break reduction tabs off surgical implants without the instrument itself breaking and without the instrument flexing so much while attempting to break a reduction tab that the instrument cannot exert enough force on the reduction tab to cause the reduction tab to break.

FIGS. **1-7** illustrate an embodiment of a surgical instrument **100** configured to break and retain multiple reduction tabs of one or more surgical implants. As shown in FIGS. **1** and **2**, the instrument **100** can include an elongate shaft **102** having a proximal end **102***p* and a distal end **102***d*. The shaft **102** can have an opening **104** formed at the distal end **102***d* thereof. The opening **104** can be configured to receive a first reduction tab **106***a* of a surgical implant therein. The opening **104** can also be configured to receive a second reduction **106***b* of the surgical implant therein, as discussed further below. FIGS. **1**, **2**, and **4** show the first reduction tab **106***a* received in the opening **104**, while FIG. **3** shows the opening **104** without the first reduction tab **106***a*, the second reduction tab **106***b*, or any other reduction tab in the opening **104**. The first and second reduction tabs **106***a*, **106***b* in the illustrated embodiment extend upwardly from a head **108** of a spinal anchor assembly. For ease of illustration, the spinal anchor assembly is only partially illustrated in FIGS. **1** and **2**, e.g., a threaded polyaxial shank extending from the head **108** is not shown.

The shaft **102** can also include a retention element **110** at least partially disposed within the shaft **102**. The retention element **110** can be disposed adjacent the opening **104** and can be configured to hold the first reduction tab **106***a* in a fixed position relative to the shaft **102** when the first reduction tab **106***a* is received in the opening **104**. In other words, when the first reduction tab **106***a* is received in the opening **104**, the retention element **110** can directly engage the reduction tab **106***a* so as to retain the first reduction tab **106***a* in place. The retention element **110** can thus be configured to facilitate breakage of the first reduction tab **106***a* from the surgical implant that includes the head **108** by helping to hold the first reduction tab **106***a* in a fixed position relative to the shaft **102** when the first reduction tab **106***a* is being broken via manual manipulation of the shaft **102**. As shown in FIG. **2**, the shaft **102** can also include a chamber **112** formed therein configured to hold broken reduction tabs therein at least after the first reduction tab **106***a* has been broken off the head **108**. The retention element **110** can be configured to prevent broken reduction tabs from being released from the chamber **112** in cooperation with a release mechanism **114** of the instrument **100**, as discussed further below.

The shaft **102** can have a variety of sizes, shapes, and configurations. The shaft **102** can generally have an elongate shape, which can facilitate insertion of at least a portion of the shaft **102** into a body of a patient. The shaft **102** in the illustrated embodiment has a cylindrical shape along a longitudinal length thereof in a proximal region of the shaft **102**, although the proximal region of the shaft **102** can have a shape other than cylindrical. The cylindrical shape can facilitate smooth insertion of the shaft **102** through into a patient's body, either directly or through an introducer device such as a cannula. A person skilled in the art will appreciate that the proximal region of the shaft **102** may not be precisely cylindrical due to manufacturing tolerances but nevertheless be considered cylindrical. The proximal region of the shaft **102** can have a width that is greater than a width of a distal region of the shaft **102**, which can facilitate retention of a plurality of broken retention tabs within the shaft **102** in the proximal region thereof, provide adequate space in the shaft **102** for the retention element **110** and/or the release mechanism **114**, and/or facilitate secure holding of a reduction tab by the retention element **110** in the distal region of the shaft **102**. The distal region of the shaft **102** can have a shape different than that of the proximal region, as in the illustrated embodiment in which the distal region has a rectangular box shape, or a same shape as the proximal region. The distal portion can have a shape other than as a rectangular box, but by having planar sides such as by having rectangular box shape, the distal portion can facilitate advancement of broken reduction tabs proximally within the shaft **102**.

At least a portion of the shaft **102** can be configured to be advanced into a body of a patient. The portion of the shaft **102** configured to be so advanced can include at least the distal end **102***d* of the shaft **102** including the opening **104**, thereby allowing the shaft **102** to facilitate breaking the reduction tab **106***a* off the implant after the implant has been implanted into the patient's body, e.g., after the shank of the implant has been threaded into bone.

The opening **104** at the distal end **102***d* of the shaft **102** can have a variety of sizes, shapes, and configurations. In an exemplary embodiment, the opening **104** can have a generally rectangular shape, as shown in FIG. **3**, in which the opening **104** has a generally rectangular shape with rounded edges. By having a generally rectangular shape, the opening **104** can be configured to interchangeably receive reduction tabs therein having a concave side facing the retention element **110**, such as the first retention tab **106***a* as shown in FIGS. **1**, **2**, **4**, **6**, and **7** and a third reduction tab **106***c* disposed within the chamber **112** as shown in FIGS. **2-4**, **6**, and **7**, or having a convex side facing the retention element **110**, such as a fourth reduction tab **106***d* and a fifth reduction tab **106***e* as shown in FIGS. **2-4**, **6**, and **7**. Because a same surgical implant can include a plurality of reduction tabs with one or more of the tabs having a different orientation than one or more of the other tabs when the tabs are attached to the implant, such as the illustrated implant having reduction tabs **106***a*, **106***b* with facing concave surfaces, the opening **104** having a shape configured to interchangeably receive the differently oriented reduction tabs can allow the differently oriented reduction tabs to be received therein without having to rotate the opening **104** relative to the implant. The shaft **102** can thus be sequentially receive reduction tabs within the opening **104** without the shaft **102** needing to be turned over or otherwise repositioned within a surgeon's hand when successively breaking multiple tabs off one or more surgical implants, which can save time and/or make the instrument **100** easier to use in a small surgical space.

In another embodiment (not shown), an opening at a distal end of an elongate shaft can have an arc shape mimicking an arced cross-sectional shape of a reduction tab, such as the first, second, third, fourth, and fifth reduction tabs **106***a*, **106***b*, **106***c*, **106***d*, **106***e* which have arced cross-sections. The

arced cross-sectional shape of the opening can help ensure that a particular side of a reduction tab inserted into the opening faces a retention element at least partially disposed within the shaft, which can facilitate secure holding of the tabs by the retention element, e.g., by having a convex surface of the tab protrude toward the retention element.

Referring again to the embodiment of FIGS. **1-7**, the chamber **112** formed in the shaft **102** can have a variety of sizes, shapes, and configurations. The chamber **112** can have a width that is equal to or greater than a width **104***w* of the opening **104**, shown in FIG. **3**, and can have a depth that is equal to or greater than a depth **104***d* of the opening **104**, also shown in FIG. **3**, which can help ensure that reduction tabs inserted into the opening **104** can also fit into the chamber **112**. The chamber **112** can thus have a width that is at least as large as a width of and can have a depth that is at least as large as a depth of reduction tabs configured to be received in the opening **104** and broken by the shaft **102**. In the illustrated embodiment, the chamber **112** has a width equal to the width **104***w* of the opening **104** and a depth equal to the depth **104***d* of the opening **104**.

A chamber formed in a shaft of a surgical instrument can be configured to allow broken reduction tabs to be loose therein or be non-loosely held therein. In the illustrated embodiment, the chamber **112** is configured to hold broken reduction tabs non-loosely therein with the broken reduction tabs being longitudinally aligned in a row, as shown in FIGS. **2-4**, **6**, and **7**, in an orientation relative to the shaft **102** as the tabs were inserted into the opening **104**, e.g., with a concave surface or convex surface thereof facing the retention element **110**. In another embodiment, a chamber can be configured to otherwise non-loosely hold broken reduction tabs in another way, such as by stacking broken tabs one against another similar to a deck of cards. A chamber can be configured to loosely hold broken reduction tabs therein by allowing broken reduction tabs to be freely disposed therein in no particular order and/or in no particular orientation relative to the shaft, as discussed further below.

A chamber formed in a shaft of a surgical instrument can be formed in any portion of the shaft. In some embodiments, a chamber can extend through the shaft from a position proximal to an opening formed in a distal end of the shaft to a proximal end of the shaft. As in the illustrated embodiment, the chamber **112** can extend from a position to the opening **104** formed in the distal end **102***d* of the shaft **102** to a position distal to the proximal end **102***p* of the shaft **102**, which can provide space within the shaft **102** for the release mechanism **114**, discussed further below.

The retention element **110** can have a variety of sizes, shapes, and configurations. The retention element **110** can include a bar, as in the illustrated embodiment, although the retention element **110** can have other forms, such as a coiled spring. The retention element **110** can be at least partially disposed within the shaft **102**, as in the illustrated embodiment in which a proximal portion of the retention element **110** is disposed within the shaft **102** and a distal portion of the retention element **110** is at least partially disposed outside the shaft **102**.

The retention element **110** can be positioned at least partially within the shaft **102** so as to allow the retention element **110** to directly contact a reduction tab inserted into the opening **104**, e.g., the first reduction tab **106***a* as shown in FIGS. **2**, **4**, and **6**. The retention element **110** can thus be configured to directly contact at least a distal-most reduction tab disposed within the shaft **102**. The retention element **110** can be configured to directly contact a reduction tab inserted into the opening **104** in a variety of ways. In an exemplary embodiment, the retention element **110** can include a distal portion thereof configured to direct a force toward one side of the shaft **102**, e.g., toward one side of an interior sidewall of the shaft **102**, such that the force can hold a reduction tab within the shaft **102** when the reduction tab is engaged by the force. The retention element **110** can be configured to direct the force in a variety of ways, such as by being spring loaded, as in the illustrated embodiment, such that the retention element **110** is biased toward the one side of the shaft **102**. The retention element **110** can be spring loaded by, e.g., having a proximal end thereof attached to the shaft **102**, e.g., using one or more pins **120**, as shown in FIGS. **2** and **5-7**, with a distal end of the retention element **110** being freely movable relative to the shaft **102**. The force can be strong enough to hold the first reduction tab **106***a* in the shaft **102** but be weak enough that, after the first reduction tab **106***a* has been broken and is retained within the shaft by the retention element **110**, a subsequent reduction tab, e.g., the second reduction tab **106***b*, inserted into the opening **104** can displace the first reduction tab **106***a*, e.g., push the first reduction tab **106***a* toward the chamber **112**.

The retention element **110** can have a pinch point **122** in a distal portion thereof, as shown in FIGS. **2-4**, **6**, and **7**. The pinch point **122** can be disposed adjacent to and proximal to the opening **104** and can be configured to directly contact the first retention tab **106***a* received in the opening **104** to hold the first retention tab **106***a* received in the opening **104** in a fixed position, both before and after the first reduction tab **106***a* has been broken from its associated implant, e.g., broken from the head **108**. The force applied by the retention element **110** can thus be applied at the pinch point **122**. The pinch point **122** can be disposed between the opening **104** and a distal-most end of the chamber **112**. The retention tab **110** can thus be configured to hold the first reduction tab **106***a* before the retention tab **110** is fully disposed within the chamber **112**, either loosely or non-loosely. A distance of the pinch point **122** from the opening **104** can be a distance less than a length of the first reduction tab **106***a*, which can allow the retention element **110** to directly contact the first reduction tab **106***a* at the pinch point **122** when the first reduction tab **106***a* in inserted into the opening **104**. Reduction tabs of surgical implants have known lengths, so a pinch point of a retention element can be appropriately located in an instrument to directly contact reduction tabs.

As mentioned above, the instrument **100** can be configured to receive reduction tabs oriented in different ways relative to the opening **104** in which the tabs are sequentially received. The pinch point **122** of the retention element **110** can thus be configured to engage a concave side of a reduction tab to securely hold the reduction tab within the shaft **102**, such as with the fourth and fifth reduction tabs **106***d*, **106***e*, and to engage a convex side of a reduction tab to securely hold the reduction tab within the shaft **102**, such as with the first and third reduction tabs **106***a*, **106***c*.

The distal end of the retention element distal to the pinch point **122** can bend or curve away from the side of the shaft **102** to which the retention element **110** directs the force, as shown in FIGS. **2-4**, **6**, and **7**. The bend or curve can help facilitate smooth insertion of the first reduction tab **106***a* into the opening **104** and help direct the first reduction tab **106***a* proximally into the shaft **102**.

The retention element **110** can be configured to move between a first configuration in which the retention element **110** is in a first position relative to the longitudinal axis A of the shaft **102** and a second configuration in which the retention element **110** is in a second position relative to the longitudinal axis A of the shaft **102**. The second configuration can

be radially offset from the first configuration relative to the longitudinal axis A. The retention element **110** in the first configuration can be configured to hold the reduction tab **106***a* inserted into the opening **104** in a fixed position, and the retention element **110** in the second configuration can be configured to allow the reduction tab **106***a* inserted into the opening **104**, as well as any reduction tabs disposed within the chamber **112**, e.g., the third, fourth, and fifth tabs **106***c*, **106***d*, **106***e*, to be released from the shaft **102**. The second configuration of the retention element **110** can thus be radially away from the side of the shaft **102** to which the retention element **110** is configured to direct the force, e.g., away from the interior sidewall of the shaft **102** against which the reduction tab **106***a* inserted into the opening **104** is held by the retention element **110**.

The release mechanism **114** can have a variety of sizes, shapes, and configurations. The release mechanism **114** can include a selectively actuatable plunger, as in the illustrated embodiment, although the release mechanism **114** can have other forms, as discussed further below, such as a selectively actuatable lever and a movable end cap. The release mechanism **114** can be spring loaded, e.g., with the spring **116**, as in the illustrated embodiment.

The release mechanism **114** can be at least partially disposed within the shaft **102**, as in the illustrated embodiment in which a distal portion of the release mechanism **114** is disposed within the shaft **102** and a proximal portion of the release mechanism **114** is at least partially disposed outside the shaft **102**, thereby allowing the proximal portion of the release mechanism **114** to be accessible by hand for manual actuation of the release mechanism **114**. The release mechanism **114** can be positioned at least partially within the shaft **102** so as to allow the release mechanism **114** to directly contact a portion of the retention element **110** disposed with the shaft **102**, as shown in FIG. **7**. The release mechanism **114** can be actuated, e.g., by pushing distally on the proximal end of the release mechanism **114**, thereby compressing the spring **116** and pushing a cam surface **124** of the release mechanism **114** distally against the retention element **110**. The cam surface **124** can be at a distal end of the release mechanism **114**. The cam surface **124** can include an angled cam surface, as in the illustrated embodiment as shown in FIGS. **2** and **5-7**, which can facilitate camming of the retention element **110** by the release mechanism **114**, as discussed further below.

Generally, the release mechanism **114** can be configured to be movable between a locked configuration and an unlocked configuration. In the locked configuration, shown in FIGS. **2**, **5**, and **6**, the release mechanism **114** can be configured to retain broken tabs within the shaft **102** and to prevent release of retained broken tabs from the shaft **102**. In the unlocked configuration, shown in FIG. **7**, the release mechanism **114** can be configured to allow release of retained broken tabs from within the shaft **102**. The release mechanism **114** can be configured in the unlocked configuration to allow release of retained broken tabs by pushing the cam surface **124** against the retention mechanism **110**, thereby moving the pinch point **122** away from the side of the shaft **102** to which it is forced or biased. Any reduction tab held by the retention element **110** at the pinch point **122**, e.g., the first reduction tab **106***a*, and any reduction tabs contained within the chamber **112**, e.g., the third, fourth, and fifth tabs **106***c*, **106***d*, **106***e*, can be released from the shaft **102** through the opening **104**, e.g., through gravity. The release mechanism **114** can thus be configured to allow the instrument **100** to be easily unloaded during a surgical procedure to free space within the chamber **112** for more broken tabs by allowing release of broken reduction tabs from within the shaft **102**. The release mechanism **114** can also allow the instrument **100** to continue being used during a surgical procedure to break and retain reduction tabs even after the instrument **100** has broken and retained a maximum number of broken tabs that can be contained therein.

The release mechanism **114** can be biased to the locked configuration, thereby helping to prevent an accidental release of broken tabs from the instrument **100**. In other words, a default position of the release mechanism **114** can be in the locked configuration. The release mechanism **114** can be biased to the locked configuration in a variety of ways. As in the illustrated embodiment, the release mechanism **114** can be spring-biased to the locked configuration with the spring **116**. The spring **116** can be configured to provide a biasing force to the release mechanism **114** effective to hold the release mechanism **114** in the locked configuration, e.g., with the cam surface **124** not exerting a force against the retention element **110** so as to allow the pinch point **122** of the retention element **110** to directly contact the first reduction tab **106***a* inserted into the opening **104**. Actuating the release mechanism **114** can move the release mechanism **114** between the locked configuration and the unlocked configuration.

As shown in FIG. **1**, the shaft **102** can include a slot **118** formed therein that is configured to facilitate release of broken tabs from within the shaft **102**. The slot **118** can be in communication with the chamber **112**. The slot **118** can be configured to have a tool (not shown), e.g., a rod, a scalpel tip, etc., inserted therein and into the chamber **112**. The slot **118** can be configured to allow a tool inserted therein to slide within the slot **118** to engage and push at least one broken tab within the chamber **112**. The tool can be slid distally within the slot **118** to urge broken tab(s) within the chamber **112** out of the instrument **100** through the opening **104**. The slot **118** can thus help broken tab(s) be quickly removed from within the shaft **102**, help unjam any broken tab(s) within the shaft **102** in the unlikely event that the tab(s) become jammed therein, and/or help clear foreign material (e.g., tissue, blood, etc.) other than broken tab(s) from within the shaft **102**. The tool can be slid within the slot **118** whether or not any broken tabs are within the chamber **112**, which can facilitate clearing the chamber **112** of foreign material to, e.g., clear space for broken tabs to be disposed within the chamber **112**.

Although the slot **118** can have a variety of configurations and positions in the shaft **102**, in the illustrated embodiment, the slot **118** is a longitudinal slot extending parallel to a longitudinal axis A of the shaft **102** and extending between a distal point proximal to the distal end **102***d* of the shaft **102** and a proximal point distal to the proximal end **102***p* of the shaft **102**. The proximal point can be adjacent to a proximal end of the chamber **112**, which can facilitate pushing broken tabs within the chamber **112** distally using a tool inserted into the slot **118**. The slot **118** can be formed on an opposite side to which the pinch point **122** is biased, as in the illustrated embodiment.

The first reduction tab **106***a* received in the opening **104** at the distal end **102***d* of the shaft **102** can be broken off its associated surgical implant in a variety of ways. In an exemplary embodiment, the shaft **102** can be configured to break the first reduction tab **106***a* by rotating about the longitudinal axis A of the shaft **102**, e.g., by manual rotation of the shaft **102**, and/or by angularly orienting the shaft **102** relative to the first reduction tab **106***a*, e.g., by manually tilting the shaft **102**. The rotational force and/or torsional force applied by the shaft **102** to the first reduction tab **106***a* can cause the first reduction tab **106***a* to snap off its associated implant. The retention element **110** can engage and hold the first reduction tab **106***a* within the shaft **102** prior to breakage of the first

reduction tab **106***a*, as discussed above, and the retention element **110** can accordingly retain and hold the first reduction tab **106***a* within the shaft **102** post-breakage. The first reduction tab **106***a* after being broken from its associated implant can thus be securely held within the shaft **102**, e.g., cannot be released therefrom without actuating the release mechanism **114**.

FIG. **6** illustrates the first reduction tab **106***a* disposed in the shaft **102** and held therein by the retention element **110** after being broken off the tab's associated surgical implant, e.g., snapped off the head **108** of the implant. From the locked configuration of FIG. **6**, the release mechanism **114** can be actuated, e.g., the plunger can be pushed distally, as shown in FIG. **7**, to move the release mechanism **114** to the unlocked configuration to allow the broken first reduction tab **106***a* and the broken reduction tabs **106***c*, **106***d*, **106***e* disposed in the chamber **112** to be released from the shaft **102**.

Below are discussions of various other embodiments of surgical instruments configured to break and retain multiple reduction tabs of one or more surgical implants. The various embodiments discussed below can generally be configured and used similar to the surgical instrument **100** of FIGS. **1-7**. Additionally, like-named elements and like-illustrated elements of the surgical instrument **100** and of the surgical instruments discussed below can be configured and used similar to one another.

FIGS. **8-10** illustrate another embodiment of a surgical instrument **200** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **200** includes a shaft **202** having an opening **204** at a distal end thereof, a retention element **210**, a chamber **212** formed in the shaft **202**, a release mechanism **214**, and a longitudinal slot **218** formed in the shaft **202**. An exterior surface of the shaft **202** can include one or more grip features configured to facilitate hand gripping of the shaft **202**. The one or more grip features can help prevent the shaft **202** from slipping out of a surgeon's hand during insertion of tab(s) into the opening **204** and/or during breakage of reduction tab(s) using the shaft **202**. Non-limiting examples of the one or more grip features can include a textured surface, finger hold(s), raised protrusion(s), and depression(s). In the illustrated embodiment, the one or more grip features include a plurality of depressions **203** formed in the shaft **202**. The one or more grip features can be formed in at least a proximal portion of the shaft **202**, e.g., in a portion of the shaft **202** most likely to be manipulated by hand during use.

As shown in FIGS. **9** and **10**, the instrument **200** can include a jam release mechanism **215**. The jam release mechanism **215** can have a variety of sizes, shapes, and configurations. The jam release mechanism **215** can include a bar, as in the illustrated embodiment, although the jam release mechanism **215** can have other forms, such as a coiled spring.

The jam release mechanism **215** can be configured to facilitate release of broken reduction tabs retained in the chamber **212**. The jam release mechanism **215** can thus be configured to cooperate with the release mechanism **214** to release broken reduction tabs from the shaft **102**. The jam release mechanism **215** can be attached to the release mechanism **214** such that the jam release mechanism **215** is configured to move in tandem with the release mechanism **214**, e.g., when the release mechanism **214** moves between locked and unlocked configurations. The jam release mechanism **215** can be attached to the release mechanism **214** in a variety of ways, such as by using one or more pins **217**. The jam release mechanism **215** can be configured to have a distal end **215***d* thereof positioned in the chamber **212** distal to a cam surface **224** of the release mechanism **214** such that the release mechanism **214** moving distally causes the distal end **215***d* of the jam release mechanism **215** to move distally in the chamber **212**. The distal end **215***d* of the jam release mechanism **215** can thus be configured to distally push broken reduction tab(s) disposed in the chamber **212**, facilitating release thereof through the opening **204**. The jam release mechanism **215** can be positioned toward a side of the shaft **202** to which the retention element **210** is biased such that when the cam surface **224** of the release mechanism **214** urges the retention element **210** away from the side of the shaft **202**, the jam release mechanism **215** does not get in the way of the retention element's movement, and vice versa.

As shown in FIGS. **8-10**, the instrument **200** can include a stop element **219** configured to stop the retention element **210** from moving beyond a certain point when the release mechanism **214** is urging the retention element **210** away from the side of the shaft **202** to which the retention element **210** is biased. In this way, the retention element **210** can have movement thereof restrained to within a certain distance radially away from the shaft **202**, which can help prevent the retention element **210** from interfering with other instruments and/or other material in a surgical space. The stop element **219** can have a variety of sizes, shapes, and configurations. As in the illustrated embodiment, the stop element **219** can include a bar spanning across the slot **218** in a distal portion of the slot **218**.

FIGS. **11-14** illustrate another embodiment of a surgical instrument **300** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **300** includes a shaft **302** having an opening **304** at a distal end thereof, one or more grip features **303** on the shaft **302**, a retention element **310**, a chamber **312** formed in the shaft **302**, a release mechanism **314**, a jam release mechanism **315**, a stop element **319**, and a longitudinal slot **318** formed in the shaft **302**. The jam release mechanism **315** in the illustrated embodiment is not attached to the release mechanism **314** so as to move in tandem therewith. Instead, the jam release mechanism **315** is configured to be movable independent of the release mechanism **314**. In other words, the jam release mechanism **315** can be selectively actuated separate from the release mechanism **314** to facilitate removal of broken reduction tab(s) from within the shaft **302**. The jam release mechanism **315** can be configured to be selectively actuated in a variety of ways. As in the illustrated embodiment, the jam release mechanism **315** can include an actuator **315***a* configured to be manipulated to move the jam release mechanism **315** relative to the shaft **302**. The actuator **315***a* can be configured to be manually actuated, such as by sliding the actuator **315***a* longitudinally back and forth, e.g., proximally and distally, thereby allowing the jam release mechanism **315** to move back and forth within the chamber **312** to help unjam any jammed broken reduction tabs contained therein. The jam release mechanism **315** can include a post **315***p* coupled to the actuator **315***a* and configured to move within a second slot **321**, shown in FIG. **14**, formed in the shaft **302** to help guide the jam release mechanism **315** back and forth relative to the shaft **302**.

FIGS. **15-19** illustrate another embodiment of a surgical instrument **400** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **400** includes a shaft **402** having an opening **404** at a distal end thereof, a retention element **410**, and a chamber **412** formed in the shaft **402**. The chamber **412** can be configured to loosely retain broken reduction tabs therein. The chamber **412** can extend along a majority of a longitudinal length of the shaft **402**, which can help maximize a number of broken reduction tabs that can be simultaneously retained therein. To

enter the chamber **412** so as to be loosely held therein, a broken reduction tab held by a pinch point **422** of the retention element **410** can be pushed proximally toward the chamber **412** by a reduction tab inserted into the opening **404** immediately subsequent to the broken reduction tab. Depending on the lengths of the broken reduction tab and the immediately subsequent reduction tab, the broken reduction tab may be pushed fully into the chamber **412** or may be pushed toward the chamber **412** in a channel **411**, shown in FIGS. **16**, **18**, and **19**, extending between and connecting the opening **404** and the chamber **412** without being fully disposed therein until another reduction tab is inserted into the opening **404**.

Broken reduction tabs loosely disposed in the chamber **412** can be released from the shaft **402** by turning the shaft **402** and allowing the broken reduction tabs to slide out of an open proximal end **402***p* of the shaft **402**. The shaft **402** can optionally include an end cap (not shown) at the proximal end **402***p* thereof that can serve as a release mechanism configured to retain the broken reduction tabs within the shaft **402** until actuation of the end cap, e.g., removal or opening thereof. The end cap can be attached to the shaft **402** and movable relative thereto in a variety of ways, e.g., mateable threads, a hinged connection similar to a flip-top lid, a magnetic connection, etc.

The retention element **410** can be spring loaded by, e.g., having a proximal end thereof attached to the shaft **402**, e.g., using a spring **421**, as shown in FIG. **16** (the spring **421** is not shown for clarity in FIGS. **18** and **19**), and having an intermediate point thereof attached to the shaft **402** at a pivot point thereof, e.g., using a pin **420**, as shown in FIGS. **15**, **16**, **18**, and **19**, such that the retention element **410** can pivot about the pin **420** as the spring **421** compresses and decompresses. FIGS. **15-18** illustrate the retention element **410** in a first configuration in which the retention element **410** can be configured to hold a reduction tab inserted into the opening **404** in a fixed position, and FIG. **19** illustrates the retention element **410** in a second configuration in which the retention element **410** can be configured to allow a reduction tab inserted into the opening **404**, as well as any reduction tabs disposed within the chamber **412** to be released from the shaft **402** through the opening **404** and/or through the open proximal end **402***p*.

FIGS. **20-23** illustrate another embodiment of a surgical instrument **500** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **500** includes a shaft **502** having an opening **504** at a distal end thereof, a retention element **510**, and a chamber **512** formed in the shaft **502**. The retention element **510** can be spring loaded and can be pivotable using a spring **521** (not shown in FIG. **22** for clarity of illustration) and a pivot pin **520**, similar to the spring **421** and the pin **420** of the embodiment illustrated in FIGS. **15-19**. The retention element **510** can be configured as a release mechanism of the instrument **500** by being configured to be selectively, manually movable between a first configuration in which the retention element **510** can be configured to hold a reduction tab inserted into the opening **504** in a fixed position, and a second configuration in which the retention element **510** can be configured to allow a reduction tab inserted into the opening **504**, as well as any reduction tabs disposed within the chamber **512** to be released from the shaft **502** through the opening **504**. Also, the retention element **510** in the second configuration can allow an unbroken reduction tab held by a pinch point **522** of the retention element **510** to be released from the instrument **500** through the opening **504**. Similar to that discussed above regarding the instrument **100** of FIGS. **1-7**, in the second configuration, the retention element **510** can be radially offset from the first configuration relative to a longitudinal axis A**5** of the shaft **502** such that the pinch point **522** of the retention element **510** can be radially offset from its position in the first configuration relative to the longitudinal axis A**5**. FIGS. **20**, **21**, and **23** show the retention element **510** in the first configuration, and FIG. **22** shows the retention element **510** in the second configuration.

The retention element **510** can be configured to be selectively, manually movable between the first and second configurations in a variety of ways. In the illustrated embodiment, the retention element **510** includes a manually depressible tab **510***t* at a proximal end thereof. The manually depressible tab **510***t* can be selectively pushed down, e.g., radially inward, which can cause the retention element **510** to pivot about the pivot pin **520** and cause the pinch point **522** to move up, e.g., radially outward. Releasing the manually depressible tab **510***t* can allow the retention element **510** to pivot about the pivot pin **520** and cause the pinch point **522** to move down.

Similar to the chamber **412** of the embodiment illustrated in FIGS. **15-19**, the chamber **512** can be configured to loosely retain broken retention tabs therein, and the shaft **502** can be configured to release broken retention tabs retained therein through an open proximal end **502***p* thereof and/or through the opening **504**. The open proximal end **502***p* can optionally include an end cap (not shown) closing the proximal end **502***p* such that loose tabs in the chamber **512** cannot be released through the proximal end **502***p* without first releasing the end cap, e.g., flipping the end cap open, unthreading the end cap from the shaft **502**, etc.

FIGS. **24-29** illustrate another embodiment of a surgical instrument **600** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **600** includes a shaft **602** having an opening **604** at a distal end thereof, a retention element **610**, a chamber **612** formed in the shaft **602**, and a release mechanism **614**. The retention element **610** can be spring biased by having a proximal end thereof attached to the shaft **602** by compression fit as in the illustrated embodiment or in another way, e.g., using one or more pins (not shown), with a distal end of the retention element **610** being freely movable relative to the shaft **602**.

The release mechanism **614** can include a lever configured to be selectively, manually actuatable to move the retention element **610** between first and second configurations to allow broken reduction tabs to be selectively released from the shaft **602** through the opening **604** and/or to allow an unbroken reduction tab held by a pinch point **622** of the retention element **610** to be released from the instrument **600** through the opening **604**. The shaft **602** can include a recessed portion **602***c*, shown in FIGS. **26** and **29**, formed therein that can be configured to seat the lever and allow movement of the lever therein, which can help prevent the lever from interfering with other materials, e.g., instruments, tissue, etc., in a surgical space. As shown in FIGS. **25**, **27**, and **28**, the release mechanism **614** can include a cam **614***c*, e.g., at a distal end thereof, configured to engage the retention element **610** to move the retention element **610** between the first and second configurations. The cam **614***c* can be configured to rotate in response to manual actuation of the lever, thereby allowing the retention element **610** to pivot. FIGS. **24-27** and **29** show the retention element **610** in the first configuration, and FIG. **28** shows the retention element **610** in the second configuration.

Similar to the chamber **412** of the embodiment illustrated in FIGS. **15-19**, the chamber **612** can be configured to loosely retain broken retention tabs therein, and the shaft **602** can be configured to release broken retention tabs retained therein

through an open proximal end **602***p* thereof and/or through the opening **604**. The open proximal end **602***p* can optionally include an end cap (not shown) closing the proximal end **602***p* such that loose tabs in the chamber **612** cannot be released through the proximal end **602***p* without first releasing the end cap. The end cap and the lever can both be release mechanisms for the instrument **600**.

FIGS. **30-34** illustrate another embodiment of a surgical instrument **700** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **700** includes a shaft **702** having an opening **704** at a distal end thereof, a retention element **710**, a chamber **712** formed in the shaft **702**, and a release mechanism **714**. Similar to the retention element **610** in the embodiment of FIGS. **24-29**, the retention element **710** can be spring biased by having a proximal end thereof attached to the shaft **702** by compression fit as in the illustrated embodiment or in another way, with a distal end of the retention element **710** being freely movable relative to the shaft **702**. The release mechanism **714** can, similar to the release mechanism **614** in the embodiment of FIGS. **24-29**, include a cam **714***c* and a lever configured to be selectively, manually actuatable to move the retention element **710** between first and second configurations to allow broken reduction tabs to be selectively released from the shaft **702** through the opening **704** and/or to allow an unbroken reduction tab held by a pinch point **724** of the retention element **714** to be released from the instrument **700** through the opening **704**. FIGS. **30-33** show the retention element **710** in the first configuration, and FIG. **34** shows the retention element **710** in the second configuration.

Similar to the chamber **412** of the embodiment illustrated in FIGS. **15-19**, the chamber **712** can be configured to loosely retain broken retention tabs therein, and the shaft **702** can be configured to release broken retention tabs retained therein through an open proximal end **702***p* thereof and/or through the opening **704**. The open proximal end **702***p* can optionally include an end cap (not shown) closing the proximal end **702***p* such that loose tabs in the chamber **712** cannot be released through the proximal end **702***p* without first releasing the end cap. The end cap and the lever can both be release mechanisms for the instrument **700**.

FIG. **35** illustrates another embodiment of a surgical instrument **800** configured to configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **800** includes a shaft **802** having an opening **804** at a distal end thereof, a retention element **810**, a chamber **812** formed in the shaft **802**, and a release mechanism **814**. The retention element **810** can be spring loaded by, e.g., having a proximal end thereof attached to the shaft **802**, e.g., using a spring **821**, and having an intermediate point thereof attached to the shaft **802** at a pivot point thereof, e.g., using a pin **820**, similar to the retention element **410** of the embodiment illustrated in FIGS. **15-19**. The release mechanism **814** can include a slidable bar configured to be selectively, manually actuatable to move the retention element **810** between first and second configurations to allow broken reduction tabs to be selectively released from the shaft **802** through the opening **804** and/or to allow an unbroken reduction tab held by a pinch point **822** of the retention element **810** to be released from the instrument **800** through the opening **804**. The slidable bar can be configured to be longitudinally movable, e.g., parallel to a longitudinal axis A**8** of the shaft **802**, to pivot the retention element **810** to about the pin **820**, thereby moving the punch point **822** up (e.g., radially outward) and down (e.g., radially inward). A distal end **814***d* of the release mechanism **814** can be configured to slide along a surface **810***s* of the retention element **810** as the release mechanism **814** is selectively moved back and forth to selectively pivot the retention element **810**. A proximal portion of the release mechanism **814** can extend proximally beyond a proximal end **802***p* of the shaft **802**, thereby facilitating manual sliding movement of the release mechanism **814**.

Similar to the chamber **412** of the embodiment illustrated in FIGS. **15-19**, the chamber **812** can be configured to loosely retain broken retention tabs therein, and the shaft **802** can be configured to release broken retention tabs retained therein through an open proximal end **802***p* thereof and/or through the opening **804**. The open proximal end **802***p* can optionally include an end cap (not shown) closing the proximal end **802***p* such that loose tabs in the chamber **812** cannot be released through the proximal end **802***p* without first releasing the end cap. The end cap and the slidable bar can both be release mechanisms for the instrument **800**.

FIGS. **36** and **37** illustrate another embodiment of a surgical instrument **900** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **900** includes a shaft **902** having an opening **904** at a distal end thereof, a retention element **910**, a chamber (not shown) formed in the shaft **902**, and a release mechanism **914**. The retention element **910** can be spring loaded by, e.g., having a proximal end thereof attached to the shaft **902**, e.g., using a spring, and having an intermediate point thereof attached to the shaft **902** at a pivot point thereof, e.g., using a pin **920**, similar to the retention element **410** of the embodiment illustrated in FIGS. **15-19**.

Similar to the release mechanism **814** of the embodiment illustrated in FIG. **35**, the release mechanism **914** can include a slidable bar configured to be selectively, manually actuatable to move the retention element **910** between first and second configurations to allow broken reduction tabs to be selectively released from the shaft **902** through the opening **904** and/or to allow an unbroken reduction tab held by a pinch point **922** of the retention element **910** to be released from the instrument **900** through the opening **904**. The slidable bar can be configured to be longitudinally movable, e.g., parallel to a longitudinal axis A**9** of the shaft **902**, to pivot the retention element **910** up and down. A distal end **914***d* of the release mechanism **914** can be configured to slide along a surface **910***s* of the retention element **910** as the release mechanism **914** is selectively moved back and forth to selectively pivot the retention element **910**. A proximal portion of the release mechanism **914** can include one or more grip features **914***g* configured to facilitate hand gripping of the release mechanism **914**. The one or more grip features **914***g* in this illustrated embodiment includes a ridged, raised protrusion, but as mentioned above, grip features of an instrument can be configured in a variety of ways.

Similar to the chamber **412** of the embodiment illustrated in FIGS. **15-19**, the chamber can be configured to loosely retain broken retention tabs therein, and the shaft **902** can be configured to release broken retention tabs retained therein through a proximal end **902***p* thereof and/or through the opening **904**. The proximal end **902***p* can optionally include an end cap **901** closing the proximal end **902***p* such that loose tabs in the chamber cannot be released through the proximal end **902***p* without first releasing the end cap **901**. The end cap **901** in the illustrated embodiment is threadably connected to the proximal end **902***p* of the shaft **902**, but as mentioned above, the end cap **901** can be attached to the shaft **902** in any of a variety of ways. The end cap **901** and the slidable bar can both be release mechanisms for the instrument **900**. The end cap **901** can have a cut-out **901***c* therein configured to allow slidable movement of the slidable bar therein.

FIGS. **38-40** illustrate another embodiment of a surgical instrument **1000** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **1000** includes a shaft **1002** having an opening **1004** at a distal end thereof, a retention element **1010**, and a chamber (not shown) formed in the shaft **1002**. Similar to the retention element **510** of the embodiment illustrated in FIGS. **20-23**, the retention element **1010** can be configured as a release mechanism of the instrument **1000** by being configured to be selectively, manually movable between a first configuration in which the retention element **1010** can be configured to hold a reduction tab inserted into the opening **1004** in a fixed position, and a second configuration in which the retention element **1010** can be configured to allow a reduction tab inserted into the opening **1004**, as well as any reduction tabs disposed within the chamber to be released from the shaft **1002** through the opening **1004**.

The retention element **1010** can be configured to be selectively, manually movable in a variety of ways, such as by manually moving the retention element **1010** away from a side S of the shaft **1002** to which the retention element **1010** is biased, e.g., in an angled proximal direction indicated by arrow R in FIG. **39**, to move the retention element **1010** from the first configuration to the second configuration. The retention element **1010** can be moved in a direction opposite to the arrow R to move the retention element **1010** from the second configuration to the first configuration. The retention element **1010** can be biased to the first configuration such that removing manual force from the retention element **1010** when the retention element **1010** is in the second configuration can cause the retention element **1010** to automatically move to from the second configuration to the first configuration. The direction of the arrow R is a non-limiting direction. The retention element **1010** can include one or more grip features **1010***g* configured to facilitate hand gripping of the retention element **1010**. The one or more grip features **1010***g* in this illustrated embodiment includes a raised protrusion, but as mentioned above, grip features of an instrument can be configured in a variety of ways.

Similar to the slot **118** in the embodiment illustrated in FIGS. **1-7**, the shaft **1002** can include a slot **1018**, shown in FIG. **40**, formed therein that is configured to facilitate release of broken tabs from within the shaft **1002**. The slot **1018** can be a longitudinal slot extending parallel to a longitudinal axis A**10** of the shaft **1002** and can be on a same side S of the shaft **1002** to which the retention element **1010** can be biased, and can be opposite a pinch point (not shown) of the retention element **1010**, which can help facilitate removal of one or more reduction tabs in a distal portion of the device.

Similar to the chamber **412** of the embodiment illustrated in FIGS. **15-19**, the chamber can be configured to loosely retain broken retention tabs therein, and the shaft **1002** can be configured to release broken retention tabs retained therein through a proximal end **1002***p* thereof and/or through the opening **1004**. Similar to the embodiment illustrated in FIGS. **36** and **37** that includes the end cap **901**, the proximal end **1002***p* of the shaft **1002** can include an end cap **1001**.

FIGS. **41** and **42** illustrate another embodiment of a surgical instrument **1100** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **1100** includes a shaft **1102** having an opening **1104** at a distal end thereof, a retention element **1110**, a chamber (not shown) formed in the shaft **1102**, and an end cap **1101**. Similar to the retention element **1010** of the embodiment illustrated in FIGS. **38-40**, the retention element **1110** can be configured as a release mechanism of the instrument **1100** by being configured to be selectively, manually movable between a first configuration in which the retention element **1110** can be configured to hold a reduction tab inserted into the opening **1104** in a fixed position, and a second configuration in which the retention element **1110** can be configured to allow a reduction tab inserted into the opening **1104**, as well as any reduction tabs disposed within the chamber to be released from the shaft **1102** through the opening **1104**. The retention element **1110** can be configured to be selectively, manually movable in a variety of ways, such as by manually moving the retention element **1110** away from a side S**11** of the shaft **1102** to which the retention element **1110** is biased. Also, the retention element **1110** can include one or more grip features **1110***g*, e.g., a raised protrusion, configured to facilitate hand gripping of the retention element **1110**. The end cap **1101** and the retention element **1110** can both be release mechanisms for the instrument **1100**.

FIGS. **43-45** illustrate another embodiment of a surgical instrument **1200** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **1200** includes a shaft **1202** having an opening **1204** at a distal end thereof, a retention element **1210**, a chamber **1212** formed in the shaft **1202**, and an end cap **1201**. The shaft **1202** can have one or more windows **1202***w* formed therein. In the illustrated embodiment, the shaft **1202** includes a plurality of windows formed therein in a proximal portion thereof adjacent the chamber **1212**. The windows **1202***w* can be configured to allow visualization of the chamber **1212**, which can facilitate determining whether the chamber **1212** is becoming so full of broken reduction tabs such that broken reduction tabs should be released therefrom, e.g., through the opening **1204** and/or through the shaft's proximal end **1202***p* (with the end cap **1202** actuated out of the way). The one or more windows **1202***w* can have a variety of sizes, shapes, and configurations. The one or more windows **1202***w* are each circular cut-outs in the shaft **1202** each having a same size in the illustrated embodiment, but any one of more of the windows **1202***w* can have a shape different from any one or more of the other windows **1202***w*, and a size different from any one or more of the other windows **1202***w*. Although the one or more windows **1202***w* are cut-outs in the illustrated embodiment, the one or more windows **1202***w* can be transparent portions of the shaft **1202***w* instead of cut-outs therein, which can help contain any fluid and/or other debris that enters the chamber **1212** through the opening **1204** from passing out of the chamber **1212** through any of the windows **1202***w*.

Similar to the retention element **1010** of the embodiment illustrated in FIGS. **38-40**, the retention element **1210** can be configured as a release mechanism of the instrument **1200** by being configured to be selectively, manually movable between a first configuration in which the retention element **1210** can be configured to hold a reduction tab inserted into the opening **1204** in a fixed position, and a second configuration in which the retention element **1210** can be configured to allow a reduction tab inserted into the opening **1204**, as well as any reduction tabs disposed within the chamber to be released from the shaft **1202** through the opening **1204**. The retention element **1210** can be configured to be selectively, manually movable in a variety of ways, such as by manually moving the retention element **1210** away from a side S**12** of the shaft **1202** to which the retention element **1210** is biased. Also, the retention element **1210** can include one or more grip features **1210***g*, e.g., a raised protrusion, configured to facilitate hand gripping of the retention element **1210**. The end cap **1201** and the retention element **1210** can both be release mechanisms for the instrument **1200**.

FIG. **46** illustrates another embodiment of a surgical instrument **1300** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **1300** includes a shaft (not shown) having an opening (not shown) at a distal end thereof, a retention element **1310**, a chamber (not shown) formed in the shaft, and a release mechanism **1314**. The retention element **1310** can be spring loaded by, e.g., having a proximal end thereof attached to the shaft using a spring element **1321**, e.g., a coil spring, a volute spring, a bellows, an elastic band, etc., such that the retention element **1310** can pivot about a pivot pin **1320**. The release mechanism **1314** can, similar to the release mechanism **814** in the embodiment shown in FIG. **35**, include a slidable bar configured to be selectively, manually actuatable to move the retention element **1310** between first and second configurations to allow broken reduction tabs to be selectively released from the shaft through the opening and/or to allow an unbroken reduction tab held by a pinch point **1322** of the retention element **1310** to be released from the instrument **1300** through the opening. The slidable bar can include first, second, and third bars **1314***b***1**, **1314***b***2**, **1314***b***3** pivotally connected to one another at first and second pivot points **1314***a*, **1314***b* such that moving the third bar **1314***b***3**, e.g., by manually moving the third bar **1314***b***3** up and down, can slide the release mechanism **1314**, e.g., a distal end of the first bar **1314***a*, along the retention element **1310**.

FIG. **47** illustrates another embodiment of a surgical instrument **1400** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **1400** includes a shaft (not shown) having an opening (not shown) at a distal end thereof, a retention element **1410**, a chamber (not shown) formed in the shaft, and a release mechanism **1414**. The retention element **1410** can be spring loaded by, e.g., having a proximal end thereof attached to the shaft using a spring element **1421**, e.g., a coil spring, a volute spring, a bellows, an elastic band, etc., such that the retention element **1410** can pivot about a pivot pin **1420**. The release mechanism **1414** can, similar to the release mechanism **814** in the embodiment shown in FIG. **35**, include a slidable bar configured to be selectively, manually actuatable to move the retention element **1410** between first and second configurations to allow broken reduction tabs to be selectively released from the shaft through the opening and/or to allow an unbroken reduction tab held by a pinch point **1422** of the retention element **1410** to be released from the instrument **1400** through the opening. The release mechanism **1414** can be slidably coupled to the release mechanism **1414** such that the release mechanism **1414**, e.g., a distal end thereof, can be slidably received in a slot **1410***s* formed in the retention element **1410**.

FIGS. **48-54** illustrate another embodiment of a surgical instrument **1500** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **1500** includes a shaft **1502** having an opening **1504** at a distal end thereof, a retention element **1510**, a chamber **1512** formed in the shaft **1502**, and an end cap **1501**.

FIG. **54** shows a distal portion of the instrument **1500** that includes the opening **1504** and the retention element **1510** as having a threaded proximal portion configured to threadably engage a threaded distal portion of the shaft **1502**. This distal portion can be attached to the shaft **1502** in another way, e.g., welding, snap fit, etc. In an exemplary embodiment, this distal portion of the instrument **1500** is not removable from the shaft **1502** once attached thereto but is threaded with the shaft **1502** so as to facilitate manufacturing of the instrument **1500**. Alternatively, this distal portion of the instrument **1500** can be configured to be removable from the shaft **1502** by unthreading the distal portion of the instrument **1500** from the shaft **1502**, which can facilitate cleaning and/or sterilization of the instrument **1500**.

Similar to that discussed above regarding the embodiment illustrated in FIGS. **15-19**, the retention element **1510** can be spring loaded, e.g., having a proximal end thereof attached to the shaft **1502**, e.g., by being welded thereto as a cantilevered spring. FIGS. **48-53** show the instrument **1500** with the retention element **1510** in a first configuration in which the retention element **1510** can be configured to hold a reduction tab inserted into the opening **1504** in a fixed position and held therein by a pinch point **1522** of the retention element **1510**. The retention element **1510** can be configured to move between the first configuration and a second configuration (not shown) in which the retention element **1510**, e.g., a portion thereof including the pinch point **1522**, has moved radially outward relative to the shaft **1502**, to holds reduction tab. The first configuration of the retention element **1510** can be the neutral or default configuration of the retention element **1510**, as in the illustrated embodiment, such that the retention element **1510** is biased to a position in which the pinch point **1522** is biased radially inward relative to the shaft **1502**, which can facilitate secure holding of a tab by the pinch point **1522**.

The retention element **1510** can be positioned on a side of the opening **1504**, e.g., along a short side of the opening **1504**, configured to be adjacent to a side edge of a reduction tab inserted into the opening **1504**. In this way, the retention element **1510** can be configured to interchangeably hold reduction tabs having a concave side or a convex side facing to a same side of the opening **1504**, e.g., to a long side of the opening **1504**. In other words, the retention element **1510** can be configured to hold a reduction tab having a curved shape regardless of the tab's orientation relative to the opening **1504** when inserted into the opening **1504**.

The instrument **1500** includes only one retention element **1510**, but the instrument **1500** can include a plurality of retention elements each configured to simultaneously hold a same tab within the opening **1504**. Having a plurality of retention elements can help securely hold a tab in a fixed position within the opening **1504**, can facilitate the holding of differently sized reduction tabs that are inserted into the opening **1504**, and/or can allow each of the retention elements to deflect less when engaging a tab so as to help the instrument **1500** take up less space within a surgical area. For example, the instrument **1500** can include a second retention element (not shown) on an opposite side of the opening **1504** from the retention element **1510**.

Similar to that discussed above regarding the embodiment illustrated in FIGS. **15-19**, the end cap **1501** can be a release mechanism for the instrument **1500**. Also similar to the embodiment illustrated in FIGS. **15-19**, the chamber **1512** can be configured to loosely retain broken retention tabs therein, and the shaft **1502** can be configured to release broken retention tabs retained therein through a proximal end **1502***p* thereof. Similar to the embodiment illustrated in FIGS. **36** and **37** that includes the end cap **901**, the proximal end **1502***p* of the shaft **1502** can include the end cap **1501**. The end cap **1501** is removably and replaceably coupled to the shaft **1502** via a threaded connection in the illustrated embodiment, but as mentioned above, the end cap **1501** can be removably and replaceably attached to the shaft **1502** in other ways, e.g., a magnetic attachment, a snap fit, etc.

The end cap **1501** can include a protrusion **1501***p* configured to be inserted into the opening **1504** when the end cap **1501** is not attached to the shaft's proximal end **1502***p*. The protrusion **1501***p* can be configured to engage and push proxi-

mally at least one broken tab within the instrument **1500** when the protrusion **1501***p* is inserted into the opening **1504**. The protrusion **1501***p* can thus help broken tab(s) be quickly removed from within the shaft **1502** even if the tab is being held by the pinch point **1522**, help unjam any broken tab(s) within the shaft **1502** in the unlikely event that the tab(s) become jammed therein, and/or help clear foreign material (e.g., tissue, blood, etc.) other than broken tab(s) from within the shaft **1502**. The protrusion **1501***p* can be inserted into the opening **1504** whether or not any broken tabs are within the chamber **1512** and/or are being held by the retention element **1510**, which can facilitate clearing foreign material to, e.g., clear space for broken tabs to be disposed within the instrument **1500**. Since the retention element **1510** can be biased to the first configuration, as mentioned above, inserting the protrusion **1501***p* into the opening **1504** can allow a tab being held by the pinch point **1522** to be pushed proximally into the chamber **1512** so as to allow the tab to be removed from the instrument **1500**, e.g., by exiting through the shaft's proximal end **1502***p* when the cap **1501** is not attached thereto.

The protrusion **1501***p* can have a variety of sizes, shapes, and configurations. The protrusion **1501***p* can have a size and shape corresponding to a size and shape of the opening **1504** so as to help maximize an amount of space the protrusion **1501***p* can clear within the instrument **1500** when inserted into the opening **1504**. In the illustrated embodiment, the protrusion **1501***p* has a rectangular box shape and a rectangular cross-sectional shape, which corresponds to a rectangular shape and a rectangular cross-sectional shape of the opening **1504**.

As shown in FIG. **53**, the protrusion **1501***p* can have a longitudinal length L**1** that is equal to or greater than a distance D**1** between a distal end of the opening **1504** and the pinch point **1522** of the retention element **1510**. The protrusion **1501***p* being at least as long as this distance D**1** can help ensure that the protrusion **1501***p* is able to push proximally a broken tab (not shown) being held at the pinch point **1522** by the retention element **1510**. In an exemplary embodiment, the protrusion's longitudinal length L**1** can be equal to or greater than a longitudinal length L**2** of the opening **1504**, which can help ensure that the protrusion **1501***p* is able to move proximally through an entire length of the opening **1504** and thereby help clear any foreign material from the opening **1504**.

The protrusion **1501***p* can extend distally from the end cap **1501**, as shown in FIGS. **58**, **60**, and **61**. The protrusion **1501***p* can be configured to be at least partially disposed within the chamber **1512** when the end cap **1501** is attached to the shaft **1502**, as shown in FIGS. **51** and **53**, in which the protrusion **1501***p* is shown partially disposed in a proximal portion of the chamber **1512**. The protrusion **1501***p* can thus be unobtrusively coupled to the instrument **1500** so as to not interfere with a user's handling of the instrument **1500**.

FIGS. **55-61** illustrate another embodiment of a surgical instrument **1600** configured to break and retain multiple reduction tabs of one or more surgical implants. The surgical instrument **1600** includes a shaft **1602** having an opening **1604** at a distal end thereof, a retention element **1610**, a chamber **1612** formed in the shaft **1602**, and an end cap **1601** having a protrusion **1601***p* extending therefrom.

The end cap **1601** can be configured similar to the end cap **1501** of the embodiment illustrated in FIGS. **48-54**. The protrusion **1601***p* can be configured similar to the protrusion **1501***p* of the embodiment illustrated in FIGS. **48-54**, e.g., be configured to be insertable into the opening **1604**, be configured to be at least partially disposed in the chamber **1612** when the cap **1601** is attached to the shaft **1602**, etc.

FIG. **61** shows a distal portion of the instrument **1600** that includes the opening **1604** that extends through a proximal tip component **1605**, a distal tip component **1607**, and the retention element **1610** as having a threaded proximal portion, e.g., on the proximal tip component **1605**, configured to threadably engage a threaded distal portion of the shaft **1602**. The distal portion of the instrument **1600** can be attached to the shaft **1602** in another way, e.g., welding, snap fit, etc. Similar to that discussed above with respect to the distal portion of the instrument **1500** of the embodiment illustrated in FIGS. **48-54**, this distal portion of the instrument **1600** is not removable from the shaft **1602** once attached thereto, but this distal portion of the instrument **1600** can be removable from the shaft **1602**.

As also shown in FIG. **61**, the retention element **1610** can include a plurality of retention elements, e.g., first and second opposed retention elements **1610***a*, **1610***b*. Similar to that discussed above regarding the embodiment illustrated in FIGS. **15-19**, the retention elements **1610***a*, **1610***b* can be spring loaded. The first and second opposed retention elements **1610***a*, **1610***b* can be configured to be disposed on opposed sides of the opening **1604**, e.g., along opposed short sides of the opening **1604**, configured to be adjacent to opposed side edges of a reduction tab inserted into the opening **1604**. In this way, the retention element **1610** can be configured to interchangeably hold reduction tabs having a concave side or a convex side facing to a same side of the opening **1604**, e.g., to a long side of the opening **1604**. In other words, the retention element **1610** can be configured to hold a reduction tab having a curved shape regardless of the tab's orientation relative to the opening **1504** when inserted into the opening **1504**.

The first and second opposed retention elements **1610***a*, **1610***b* can be integrally formed, as in the illustrated embodiment, so as to be a single retention element component. Being a single retention element component can facilitate manufacture of the instrument **1600** by allowing for better control of manufacturing tolerances for each of the instrument's retention elements **1610***a*, **1610***b*, which can facilitate control of a distance between the retention elements **1610***a*, **1610***b* when coupled to the shaft **1604**. Alternatively, the first and second opposed retention elements **1610***a*, **1610***b* can be separate components, e.g., each be configured similar to the retention element **1500** of the embodiment illustrated in FIGS. **48-54**.

Each of the first and second retention elements **1610***a*, **1610***b* can be configured to move between first and second configurations, similar to that discussed above with respect to the retention element **1510** of the embodiment illustrated in FIGS. **48-54**.

At least a portion of the opening **1604** can have an "I" cross-sectional shape, as shown in FIGS. **55**, **56**, and **61**. The "I" cross-sectional shape can allow the opening **1604** to interchangeably receive reduction tabs therein having a concave side facing either long side of the opening **1604**, similar to that discussed above with respect to the rectangular cross-shaped opening **104** of FIGS. **1-7**. A reduced diameter portion in a middle of the "I" shape can facilitate predictable positioning of tabs sequentially inserted into the opening **1604**. The "I" cross-sectional shape can help a reduction tab inserted into the opening **1604** be aligned with an immediately previous one of the tabs inserted into the opening **1604**, even if the concave sides of the tabs face different directions, so as to effectively proximally push the immediately previous one of the tabs toward the chamber **1612**. In other words, a mid-portion of each one of the tabs inserted into the opening **1604** can be positioned in the reduced diameter portion in a middle of the "I" shape such that at least the mid-portions of sequen-

tially inserted tabs can be more likely to be aligned so as to allow the mid-portions to abut and facilitate pushing of a previously inserted tab.

In an exemplary embodiment, at least a distal portion of the opening **1604** can have the "I" cross-sectional shape. In this way, a reduction tab can be inserted into the opening **1604** in the predictable position facilitated by the "I" cross-sectional shape. In the illustrated embodiment, a distal portion of the opening **1604**, e.g., a portion of the opening **1604** in the distal tip component **1605**, has an "I" cross-sectional shape. A remainder of the opening **1604** can have another cross-sectional shape. In the illustrated embodiment, as shown in FIG. **61**, a proximal portion of the opening **1604** that extends through the retention element **1610** and the proximal tip component **1607** has a rectangular cross-sectional shape.

The devices disclosed herein can be designed to be disposed of after a single use, or they can be designed to be used multiple times. In either case, however, the device can be reconditioned for reuse after at least one use. Reconditioning can include any combination of the steps of disassembly of the device, followed by cleaning or replacement of particular pieces, and subsequent reassembly. In particular, the device can be disassembled, and any number of the particular pieces or parts of the device, e.g., the blades, can be selectively replaced or removed in any combination. Upon cleaning and/or replacement of particular parts, the device can be reassembled for subsequent use either at a reconditioning facility, or by a surgical team immediately prior to a surgical procedure. Those skilled in the art will appreciate that reconditioning of a device can utilize a variety of techniques for disassembly, cleaning/replacement, and reassembly. Use of such techniques, and the resulting reconditioned device, are all within the scope of the present application.

Preferably, the invention described herein will be processed before surgery. First, a new or used instrument is obtained and if necessary cleaned. The instrument can then be sterilized. In one sterilization technique, the instrument is placed in a closed and sealed container, such as a plastic or TYVEK bag. The container and instrument are then placed in a field of radiation that can penetrate the container, such as gamma radiation, x-rays, or high-energy electrons. The radiation kills bacteria on the instrument and in the container. The sterilized instrument can then be stored in the sterile container. The sealed container keeps the instrument sterile until it is opened in the medical facility.

It is preferred that device is sterilized. This can be done by any number of ways known to those skilled in the art including beta or gamma radiation, ethylene oxide, steam, and a liquid bath (e.g., cold soak).

One skilled in the art will appreciate further features and advantages of the invention based on the above-described embodiments. Accordingly, the invention is not to be limited by what has been particularly shown and described, except as indicated by the appended claims. All publications and references cited herein are expressly incorporated herein by reference in their entirety.

What is claimed is:

1. A surgical apparatus, comprising:

an elongate shaft having proximal and distal ends, the distal end of the elongate shaft having a tapered portion, wherein the tapered portion at the distal end has a width that is smaller than a width of the proximal end of the elongate shaft, an opening at the distal end of the shaft, and a chamber formed therein proximal to and in communication with the opening, the distal end of the shaft being configured to be advanced into a body of a patient, the opening having a rectangular shape, and the opening being configured to receive a reduction tab of a surgical implant; and

a spring-loaded finger disposed at least partially within the shaft and located adjacent the opening, the finger being configured to hold the reduction tab received in the opening in a fixed position relative to the shaft, the shaft being configured to be manipulated to break the reduction tab received in the opening and held by the finger off from the surgical implant, and the chamber being configured to have the broken reduction tab disposed therein.

2. The apparatus of claim **1**, wherein the chamber is configured to have a plurality of broken reduction tabs simultaneously disposed therein.

3. The apparatus of claim **1**, wherein the opening is configured to sequentially receive the reduction tab and a plurality of additional reduction tabs of one or more surgical implants, the finger being configured to sequentially hold the reduction tab and each of the plurality of additional reduction tabs in a fixed position relative to the shaft, the shaft being configured to be manipulated to break each of the plurality of additional reduction tabs received in the opening and held by the finger off of the one or more surgical implants, the chamber being configured to have the reduction tab and each of the broken additional reduction tabs simultaneously disposed therein.

4. The apparatus of claim **3**, wherein a first one of the plurality of reduction tabs is configured to move the broken reduction tab from the fixed position and into the chamber, each of a remainder of the plurality of reduction tabs being configured to move an immediately preceding broken one of the reduction tabs from the fixed position and into the chamber.

5. The apparatus of claim **3**, wherein a first one of the plurality of reduction tabs is configured to move the broken reduction tab proximally within the shaft, each of a remainder of the plurality of reduction tabs being configured to move an immediately preceding broken one of the reduction tabs proximally within the shaft.

6. The apparatus of claim **1**, wherein the finger directs a force toward an interior sidewall of the shaft such that the reduction tab received in the opening is held between the finger and the interior sidewall of the shaft.

7. The apparatus of claim **1**, wherein the finger has a pinch point in a distal portion thereof, the pinch point being disposed adjacent to and proximal to the opening and being configured to directly contact the reduction tab received in the opening so as to hold the reduction tab received in the opening in the fixed position.

8. The apparatus of claim **1**, wherein the finger is configured to move between a first configuration in which the finger is in a first position relative to a longitudinal axis of the shaft and a second configuration in which the finger is in a second position relative to the longitudinal axis of the shaft, the second position being radially offset from the first position relative to the longitudinal axis.

9. The apparatus of claim **1**, wherein the shaft has a proximal opening in a proximal portion thereof, the proximal opening being in communication with the chamber such that any broken reduction tabs held in the chamber can be released from the chamber through the proximal opening.

10. The apparatus of claim **1**, further comprising a release element coupled to the finger, the release element being configured to be actuated to cause any broken reduction tabs of surgical implants held in the chamber to be released from the chamber through the opening.

11. A kit comprising:

one or more surgical implants, each surgical implant having a receiver member that defines a rod-receiving recess, and a breakable extension tab that extends proximally from the receiver member;

an elongate shaft having an opening at a distal end thereof and a chamber formed therein that is in communication with the opening, the opening being configured to sequentially receive a plurality of breakable extension tabs of the one or more surgical implants therein, the shaft being configured to be manipulated to sequentially break each of the breakable extension tabs off the one or more surgical implants, and the chamber being configured to retain each of the breakable extension tabs therein after the breakable extension tabs have been broken off the one or more surgical implants by manipulating the shaft; and

a retention element disposed at least partially within the shaft and located adjacent the opening, the retention element being configured to sequentially engage each of the breakable extension tabs received in the opening within the shaft before the shaft is manipulated to sequentially break each of the breakable extension tabs off the one or more surgical implants, and the retention element being configured to hold within the shaft each of the breakable extension tabs after having been broken off the one or more surgical implants by manipulating the shaft.

12. The apparatus of claim 11, wherein each of the broken breakable extension tabs except a last one of the broken breakable extension tabs is displaced from being held by the retention element by a subsequent one of the breakable extension tabs received in the opening so as to sequentially advance each of the broken breakable extension tabs except the last one of the broken breakable extension tabs into the chamber.

13. The apparatus of claim 11, wherein the chamber is configured to have a plurality of breakable extension tabs simultaneously disposed therein.

14. The apparatus of claim 13, wherein the plurality of broken breakable extension tabs is at least five tabs.

15. The apparatus of claim 13, wherein the plurality of broken breakable extension tabs is in a range of five to fifty tabs.

16. The apparatus of claim 11, wherein the retention element has a pinch point in a distal portion thereof, the pinch point being configured to directly contact the breakable extension tab received in the opening so as to hold the breakable extension tab received in the opening in the fixed position.

17. A surgical method, comprising:

disposing a first reduction tab of a first surgical implant implanted within a patient within an opening at a distal end of an elongate shaft such that a spring-loaded finger disposed at least partially within the shaft engages the first reduction tab, the first reduction tab extending proximally from a first receiver member of the first surgical implant, the first receiver member defining a rod-receiving recess;

manipulating the shaft to break the first reduction tab disposed within the opening off of the first surgical implant;

retaining the broken first reduction tab within the shaft by the finger holding the broken first reduction tab in a fixed position relative to the shaft;

disposing a second reduction tab of a second surgical implant implanted within the patient within the opening such that the finger engages the second reduction tab, the second reduction tab extending proximally from a second receiver member of the second surgical implant, the second receiver member defining a rod-receiving recess;

manipulating the shaft to break the second reduction tab disposed within the opening off of the second surgical implant; and

retaining the broken second reduction tab within the shaft such that the broken first and second reduction tabs are simultaneously retained within the shaft.

18. The method of claim 17, wherein disposing the second reduction tab within the opening moves the broken first reduction tab from being held in the fixed position relative to the shaft to being disposed within a chamber formed in the shaft.

19. The method of claim 17, wherein disposing the second reduction tab within the opening moves the broken first reduction tab proximally within the shaft.

20. The method of claim 17, wherein the finger retains the broken first reduction tab within the shaft by applying a spring force thereto, and the finger retains the broken second reduction tab within the shaft by applying a spring force thereto.

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